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The Treatment of Flue Gases.

THE two most important events of the week as regards the generation of electricity have been the dismissal of the appeal of the Manchester Corporation from the injunction granted against it by the Court of Appeal in relation to the Barton power station and the publication by the Ministry of Transport of an interim report on the treatment of sulphur fumes in connection with the Battersea power station.

The Corporation has, however, obtained by its appeal the suspension of the injunction for a further period of one year from the date of the latest judgment. This concession is, we think, an important one in the light of the successful experiments carried out at the Grove Road station for the purpose of eliminating sulphur fumes from flue gases. It is true that the acceptance by the Government Committee of the conclusions reached by the London Power Company's advisers is qualified, but caution is understandable in view of the mystery which at present surrounds the most important feature of the experiments, *viz.*, the oxidation of sulphurous to sulphuric acid during the process of hot-water scrubbing—a transformation which removes practically all sulphur fumes from the chimney emissions and ensures that, with the use of no more diluent than is obtainable from the normal quantity of condensing water, the discharge into the river shall be free from acid.

The report of the consultants suggests that with stoker-fired boilers the problem of dust emission is not difficult of solution. If the inclusion of one thing implies the exclusion of another, this statement means that they have not the same belief in the efficacy of methods adopted for dealing with such emissions from pulverised-fuel installations, a conclusion with which many will disagree. For many pulverised-fuel installations it is claimed that all but a negligible amount of the grit can be trapped. In the case of Battersea the sulphur washing plant will dispose of the dust nuisance also.

The report seems to offer very distinct promise of fruitful results when the methods used at Grove Road are applied on a larger scale at

Battersea, and we see no reason to doubt that they will be equally efficacious in the latter case.

The experiences of the Manchester Corporation and of the London Power Company provide an illustration of the difficulties that accompany the choice of a power station site. Barton is attacked because it is located in open country and destroys vegetation, Battersea because it is to be built in urban surroundings and might still further pollute the air and also injure buildings. We would, in the case of Battersea, have preferred a site several miles to the east of that selected. In addition to the obvious reasons, of which we have heard so much of late, a site further down the River Thames would have borne out the contention often advanced in favour of electricity, that it can be produced where conditions are most favourable for the purpose and transmitted to the point of most advantageous use. It must be conceded, however, that to supply London with electricity presents problems not found elsewhere. London is like no other British town in size of population and congestion of its subsoil, and since a practicable method of transmitting nearly 400,000 kW from outside, as an alternative to the Battersea station, has not been put forward, the scheme of the London Power Company holds the field.

Electrical Trade Benevolence.

THE net result of the recent annual festival of the Electrical Trades Benevolent Institution is extremely gratifying. To Mr. Howard Marryat, the festival president, to whose urgent appeals we gave prominence here several weeks ago, the remembrance of his year of leadership must always be a pleasure, because he secured substantial aid in bringing the pension stage so much nearer. We tender to him the thanks of the industry and our own congratulations. Thanks are also due to those who responded so generously, and to the Executive Committee which has always devoted itself so self-sacrificingly to the investigation of "cases," and to the administration of the Fund's affairs.

In alluding to his retirement from the full-time secretaryship and his acceptance of the honorary secretaryship, in the ELECTRICAL REVIEW for May 25th, 1928, we paid a tribute to Mr. F. B. O. Hawes for the very valued services that he had rendered to the E.T.B.I. over a long period. We also announced that Captain J. T. Keeping had been appointed to carry on the secretarial duties, with the assistance and advice of Mr. Hawes in reserve in his honorary capacity. Mr. Hawes has now definitely retired and at last week's Festival he was presented with tokens of appreciation.

From the report of the dinner, which appears elsewhere in this issue, it will be seen that Captain Keeping has more than justified his appointment by producing excellent results in the collection of donations and subscriptions by his unremitting efforts. We have felt for years past that the best interests of the Fund would be served in this way, and in congratulating the new secretary upon recent achievements, we may assure him that the industry looks to him, both on his own initiative and at the instigation and under the inspiration of the Executive, so to secure everybody's co-operative generosity that before we are all much older the payment of reasonable pensions out of interest on invested capital may be *un fait accompli*.

If we may stress one point in particular at the present stage, we would like to appeal to the leaders of the electrical industry—either personally or through their companies, or both—to find the further sums necessary to raise the funds to the pension-paying figure. Our industry is great, and to have a mere £50,000 invested for those who fall by the way is really the minimum that could be expected from it, for such a sum is small compared with what obtains in some other far less important trades. May we therefore urge that the festival fund be not considered closed, but that even now there may be such a spirit of generosity and duty abroad amongst us that without a lull the secretary may find himself in the position of being able to report to his Executive, a constant inflow of large sums until the goal, at present set, is reached? Approximately £4,000 is needed to complete the £50,000. Why wait? There are less than three weeks to Christmas! The mass of smaller sums has always been a source of strength and must continue to be so, and every donor or subscriber of these sums can feel that all the time he is helping either to keep the wolf from the door, or paying the rent, or finding health and employment, for needy folk, some of whom, perhaps, have worked side by side with him in past days; and, if a number of gentlemen or their companies will find further substantial sums, such as Mr. Marryat has been instrumental in bringing in, they will be able to feel that by making pensions possible, they have lifted the burden of a gnawing anxiety from minds of men and women who are permanently unable to help themselves. Let the recent achievement be an incentive to further immediate giving on a substantial scale, and to an all-round decision from the rank and file to do their utmost to put the finances on that sound basis which we have regarded as the ultimate objective, from the moment when the Fund was launched and we issued through these columns our first appeal on its behalf.

Education for Salesmanship.

AS will be seen from the review which appears in this issue, the interim report of the Government Committee upon Education for Salesmanship is devoted to a study of the question of marketing British goods abroad. It appears to be the object of the Committee first to state the nature of the problems which are to be encountered and then (in a final report) to shape a scheme of education which will equip men to meet those conditions. The interim report has not been written for leaders of electrical industry; it seems to have been prepared more for general consumption, to guide our legislators and educational authorities.

As a survey of the general question the report is very interesting, although little more than a recapitulation of matter which has received considerable attention in recent years in our pages and elsewhere. The British exporter is again shown his deficiencies, as compared with his foreign competitors. He is taken to task for his neglect to study the habits, customs, and regulations of the people to whom he wishes to sell his goods, and altogether he is almost beyond salvation if the evidence is to be believed.

It would appear that this evidence was, perhaps, a little one-sided, and that really our salesmanship methods are frequently far from inferior to those of our competitors. We are convinced, and our export figures show, that electrical manufacturers, at least, know a great deal regarding the marketing of their goods overseas.

Two matters which do not come within the Committee's scope, but are mentioned in passing, are prices and credit. While we have no doubt that salesmanship can be considerably improved, we think that these two problems are probably the greatest obstacles which have to be surmounted.

Thus, so far as the electrical industry is concerned, we see no reason for revising opinions which we have long held and which were expressed in an article on "Salesmanship Abroad" in our issue of October 5th, 1928.

From many points of view the second part of the report should be the more important half. The question of training for salesmanship, whether at home or abroad, is one on which experts hold different views. Schools of salesmanship certainly have not always justified their existence and they have come in for a good deal of criticism. Perhaps the report will tell us whether we are right in agreeing with Mr. E. E. Sharp's little remark at a recent E.D.A. conference, or whether Mr. Dale's view is correct. At the moment we are inclined to agree with both.

Pulverised-Fuel Firing.

As, no doubt, is the case with all new developments, there has been until recently, at any rate in this country, a certain "secrecy" about pulverised-fuel firing, and because of that the full account we are able to give, with comprehensive test data, of the plant which has been erected, tested, and is now running with marked success at the Nechells (Prince's) power station of the Birmingham Corporation in this issue will, we believe, be particularly welcomed. The installation is on the storage system, and it reopens the much-discussed question of the unit *versus* the storage system, especially in the light of the fact that at Nechells' new sister station, Hams Hall, the unit system has been adopted. Apart from the suggestion that the firing system adopted at Hams Hall savours somewhat of experiment, we believe that the two installations at Birmingham point directly to the essential difference between the two firing systems and also to the particular advantages peculiar to each method. Hams Hall will, no doubt, be a base-load station, and the "continuous-flow" principle of the unit system certainly lends itself admirably to meeting constant loads over long periods. On the other hand, the experience obtained at Nechells strongly points to the adaptability of the storage system to widely varying load conditions. We were fortunate to be at Nechells recently during Birmingham's dinner hour, at a time when the demand from one of the boilers dropped from nearly full load to something like one-tenth full load, and we were immensely impressed by the ease of control and the particularly smooth running of the plant. There was, to the "outsider," nothing but the steam-flow meter to indicate the widely varying conditions.

One very interesting feature of the Prince's equipment is Mr. R. A. Chattock's scheme to increase the efficiency by leaving the water tubes in the combustion chamber bare to the chamber interior, and in view of the results obtained and of the anticipated life of five years for the combustion chamber before renewals are necessary, the manifestation of the scheme is a creditable achievement.

Another outstanding point in connection with the installation is the electrostatic precipitating plant erected to arrest the dust from the drying plant in place of cyclones, and it is of great interest to learn that the saving in coal as a result of the plant is such as will quickly cover the capital cost of the installation. A further feature to which attention might profitably be drawn, in that it will help to allay fears of many supply men, is that pulverised fuel has been stored for five months without occurrence of spontaneous combustion.

Finally, to deal with pulverised-fuel firing in its broader sense, that is, pulverised-fuel *versus* stoker firing, it is probably a safe conclusion that for large generating stations the former system has now become definitely established as the superior one, even taking into consideration capital costs. A working efficiency of 85 per cent., taking the gross calorific value of coal, leaves a wide margin to cover various discrepancies.

Electric Bronze Furnaces.

It would be interesting to have actual figures of electric furnaces in operation in British brass foundries, especially of those that have been installed during the last two or three years. It must be admitted that the electric furnace, as far as iron and brass foundries are concerned, has not made much progress in England. It is rather surprising that the duplexing process, in which the cast iron is super-heated in the electric furnace after being melted in the cupola, has not been more generally adopted, because, for thin high grade castings, better results are obtained but the cost factor has no doubt been a deterrent. In the case of brass foundries the capital expenditure involved in many cases prevents the adoption of electric melting, and it has to be remembered that there are comparatively few large brass foundries in this country, the great majority of them being small shops employing two or three men. American founders have proved the value of electric furnaces, and one Canadian foundry has recently installed a furnace with a capacity of 350 lb. and two with a capacity of 1,000 lb. The owners had previously installed two furnaces, and the important advantages obtained in bronze melting operations made them decide on a more extensive use of electric furnaces.

Our Power Resources.

One of the most interesting compilations which resulted from the 1924 World Power Conference was a survey of the world's power resources, the figures of which have only recently been published and form the basis of an article elsewhere in this issue. In this connection it is interesting to note that invitations are now being issued for the second plenary meeting of the World Power Conference, to be held in Berlin, Germany, between June 16th and 25th, 1930. It bids fair to be one of the most important international gatherings of a technical kind that has ever been held, and a unique opportunity for an interchange of ideas on power problems. Amongst the electrical subjects which are suggested for discussion are power distribution, factory lighting, electrical applications in structural and railway engineering, electro-medical work, and radio-telephony broadcasting.

We have heard much in the past of the threatened exhaustion of power resources, but hitherto experience has shown that consumption is more than sufficiently replaced by new discoveries. Of the three main resources, *viz.*, coal, oil, and water, the last named alone does not represent destruction of the world's capital value.

As our contributor points out, the exhaustion of power resources means—to the engineer—the end of the world, and it is therefore of the first importance to him that he should "survey and study."

London Traffic Co-ordination.

When the present Government took office the majority of the House of Commons was against the traffic co-ordination scheme arranged between the London County Council and the "Underground" group. The Bills promoted to give effect to the scheme were consequently rejected, but the problem with which they were designed to deal remains and is accentuated by delay.

In a statement made in the House this week Mr. H. Morrison, Minister of Transport, said that the Government was fully alive to the necessity for a measure of co-ordination which would enable the undertakings concerned to be self-supporting, while providing adequate travelling facilities for the public. It was realised that only efficient commercial management could bring about this desirable state of affairs, but it was intended to retain the principle of public ownership. The Government proposed to consult with all the interests concerned in an endeavour to formulate an acceptable scheme, and the assistance of "an eminent chartered accountant" was to be obtained. The magnitude of the task can be gauged from the fact that the total capital involved is in the neighbourhood of £120,000,000.

It is considered unlikely that the Government will endeavour to establish purely State or municipal ownership. The formation of an authority of the nature of the Central Electricity Board would appear to be the aim.

Red and Buff.

If exhibitors in the Electrical Section of the British Industries Fair follow the suggestion of the Management (see our "Business Notices" to-day), the usual "Black and White" will give place to buff and red as the distinctive colouring. The lead in this direction has been given by the British Electrical Development Association in the attractive kiosk that it has decided to erect in a central position among the electrical exhibits, and the Electrical Advisory Committee asks that these colours should be adopted generally by electrical concerns. Ambitious E.D.A. adds "gold" to its buff and red; exhibitors will follow suit during the run of the Fair.

A Pulverised-fuel Installation.

A description, with test data, of boiler equipment, designed and erected by Messrs. Simon-Carves, Ltd., at the Nechells municipal power station, Birmingham.

THE plant about to be described constitutes the extension carried out at the Birmingham Corporation electricity works, Nechells, to the existing boiler plant, some of which was already fired with pulverised fuel. It is significant that this system of firing had proved itself sufficiently attractive over a protracted period to warrant its being employed again for the extensions. The new plant represented a very bold policy on the part of the city electrical engineer, Mr. R. A. Chattock, M.I.E.E.—to whom we are indebted for permission to publish these details—in that it includes the largest boilers at the time to be employed in Europe by any system of firing. This departure, as regards the boiler units, together with other special features embodied in these extensions, constituted a great advance in modern boiler-house practice so far as large units are concerned. Other features of this installation which are of particular interest are the water-cooled walls and roofs of the combustion chambers, and also the electrostatic precipitation of dust from the dryers.

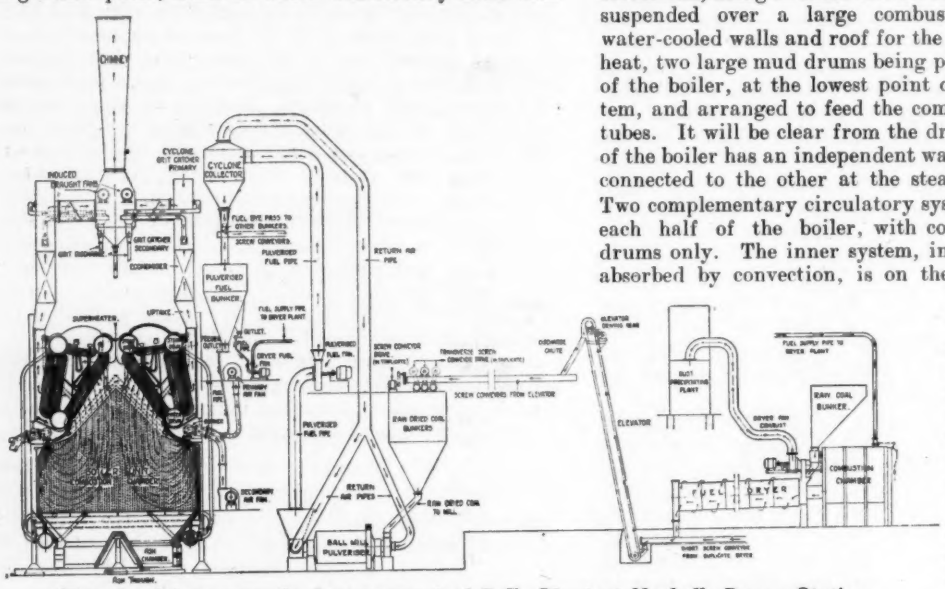


Fig. 1.—Diagrammatic Arrangement of P.F. Plant at Nechells Power Station.

This installation, the diagrammatic arrangement of which is shown in fig. 1, is operated on the "central" system of pulverised-fuel firing, comprising four rotary dryers, four ball mills, and four patent multiple-drum boilers. The boilers, fig 2, are of the steeply-inclined bent-tube type, arranged in what has been called "W" formation, being in effect two tri-drum convection boilers suspended over a large combustion chamber having water-cooled walls and roof for the absorption of radiant heat, two large mud drums being placed one on each side of the boiler, at the lowest point of the circulatory system, and arranged to feed the combustion chamber wall tubes. It will be clear from the drawings that each half of the boiler has an independent water system and is only connected to the other at the steam outlet (see fig. 3). Two complementary circulatory systems are formed in each half of the boiler, with confluence in the steam drums only. The inner system, in which heat is chiefly absorbed by convection, is on the tri-drum principle. Most of the radiant heat from combustion of the fuel is absorbed in the outer system, which embraces the combustion chamber walls and roof. The circulation has proved to be remarkably good at all loads, as is evidenced by the exceptionally steady water level gauges and absence of priming. The excellence of the general design, proportion, and disposition of heating surface is clearly shown by the results attained.

Each of the four boilers was rated originally to evaporate 150,000 to 180,000 lb. of steam per hour at 320 lb. per sq. in. pressure at the superheater inlet, the final temperature of the steam being 740 deg. F. at the

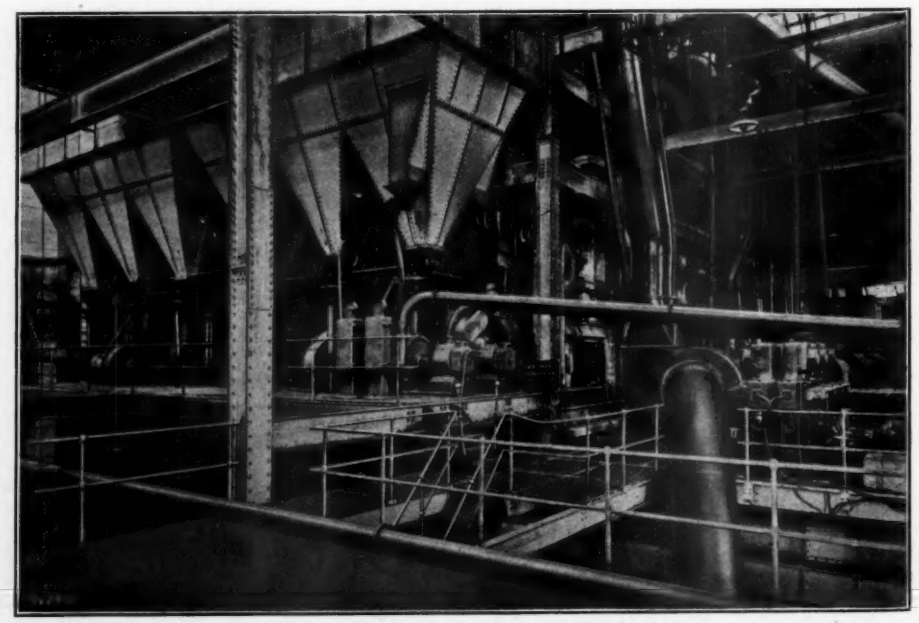


Fig. 2.—General View of Boiler Installation.

boiler stop valve. The thickness of the steam drum plates is 1½ in., and of the mud-drum plates 1 $\frac{3}{16}$ in., the diameters of the respective drums being 4 ft. 6 in. and 3 ft. 6 in. All the tubes in the combustion-chamber walls and boiler are 3¼ in. outside diameter, the first three rows of the boiler tubes being 6 gauge solid cold-drawn, and the remainder 7 gauge hot-drawn.

Each half of the boiler is provided with a " Foster "

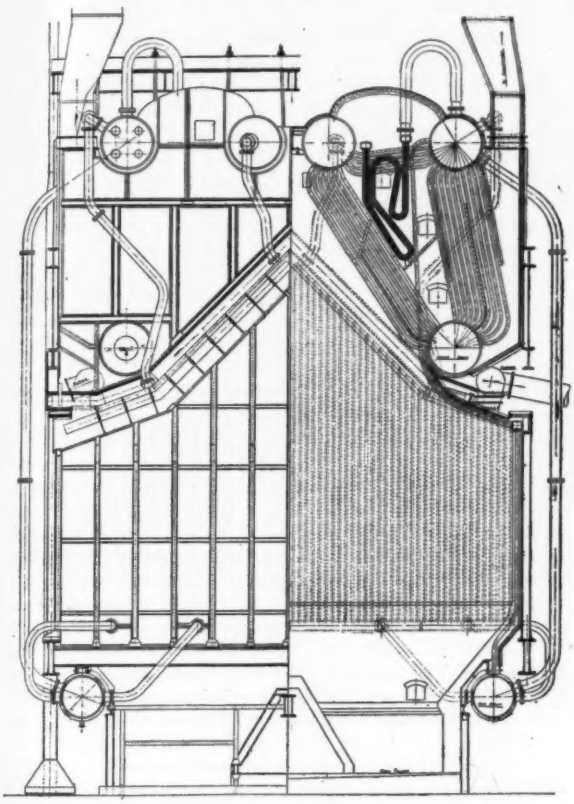


Fig. 3.—Elevation and Section of Boiler and Combustion Chamber.

economiser having an effective heating surface of 3,672 sq. ft., or 7,344 sq. ft. for each boiler unit. The two economisers are together capable of heating 150,000 lb. of water per hour from 180 deg. F. to 236 deg. F. The jointing of the tubes into the economiser is made by expanding them into the header plates, which are outside the zone of the hot gases. An obvious advantage of this design is that repairs, even the removal of elements, can be effected by by-passing the feed water past the economiser, thus obviating the provision of a by-pass flue for the flue gases and enabling repairs to be carried out with the boiler in full commission. The arrangement of the economisers permits a maximum of compactness in the necessary casing, compared with other economisers of similar duty, and makes for a minimum loss due to air leakage into the casing. The superheaters, of which there are two per boiler, each have 2,730 sq. ft. of heating surface. The tubes are of a heavy gauge and are bent cold and subsequently annealed. The superheaters are slung from the top drums from channels attached to the latter. The boilers are fitted with feed water automatic control, as well as hand control, and the level of the water in the boiler is steady at all loads.

The combustion chamber is arranged with water-cooled walls on all sides. Downcomers from the outer steam drums pass to the mud drums, and from these drums uptakes feed the bottom headers on all sides. The headers supply rows of tubes on each wall, and these tubes pass into top headers. These are connected to the steam drums by intakes on each side wall, and by a series of roof tubes extending up through the first nest of boiler tubes and expanded into the outer steam drums. The roof tubes are exposed to the radiant heat of the combustion chamber, the roof blocks being laid upon them; the tubes thus contribute appreciably to the heating surface.

The heating surfaces per boiler unit are: boiler, 16,440 sq. ft.; combustion chamber tubes, 4,700 sq. ft.; total net effective heating surface, 21,140 sq. ft.

The wall tubes were originally covered with a lining of specially shaped refractory blocks keyed round them, so as to hold each other in position. At the instance of Mr. Chattock, in an attempt to get higher efficiencies and to obtain powdered ash and obviate slagging in the chamber, it was decided to bare the water tubes, leaving a refractory wall immediately behind the tubes. The bare tube and refractory surface is so proportioned that sufficient radiation surface exists to obviate any liability of quenching the flame, either in starting up the boiler or at low load. At the same time sufficient bare-tube surface is available to avoid slagging of the ash and consequent damage to the refractory walls in the event of high loads being carried. The results obtained on the first boiler to be converted to bare tubes have fully justified Mr. Chattock's experiment, and a life of five years is expected for the combustion chamber before any renewals are necessary. The arrangement just described, while retaining simplicity in design, combines the main objects of both the all-steel and the all-refractory water-cooled wall, without possessing their drawbacks. As was to be expected, experience has shown the disadvantages of the all-steel wall to be (*a*) the quenching of the fuel particles in the excessively cold zone adjacent to the walls, and the attendant danger of " blowbacks," particularly during lighting-up and low-load periods; (*b*) excessive carbon in the ash. The disadvantages of the refractory wall are (*a*) the limitation of load due to risk of failure of refractories with excessively high CO_2 contents in the flue gases; (*b*) wear and tear due to ash slagging on the walls, particularly with low fusibility ash; and (*c*) bricks supported on the tubes by bolts and clamps complicate the combustion chamber and render repair or renewal of the chamber a difficult matter, necessitating a protracted shut-down of the boiler.

Fig. 4 gives a section showing the arrangement of the different layers constituting the insulation of the boiler, which are as follows: refractory bricks; asbestos mattress; air space; and mild-steel panelling.

This method of insulation is remarkably effective as the

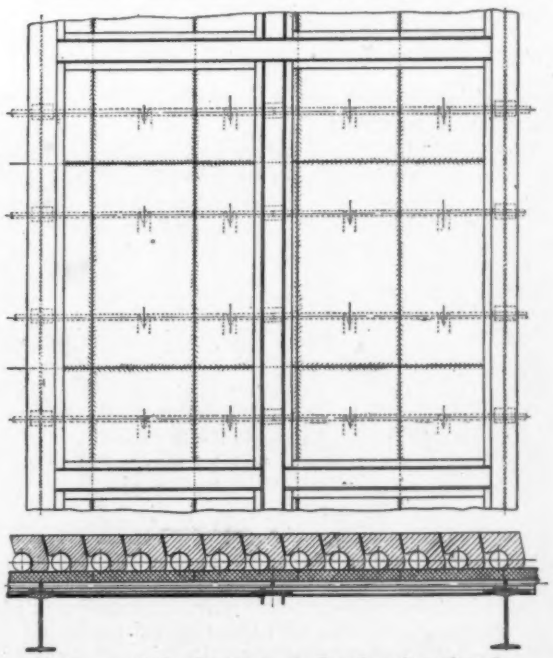


Fig. 4.—S.C. System of Combustion-chamber Insulation.

negligible radiation losses as set out later in test figures will show.

Four dryers of the rotary type are installed, each consisting of two concentric cylinders 6 ft. 8 in. in diameter and approximately 45 ft. long, slightly inclined to the horizontal, fig. 5. The dryers are fired by means of pulverised fuel, the drying gases passing down the inner

cylinder and back through the annular space where they come into direct contact with the coal travelling in the opposite direction. The coal is lifted by vanes on the outer shell and poured on to the hot central tube; it is held in contact with the tube surface for a short period as the dryer rotates by vanes mounted on the tube. The

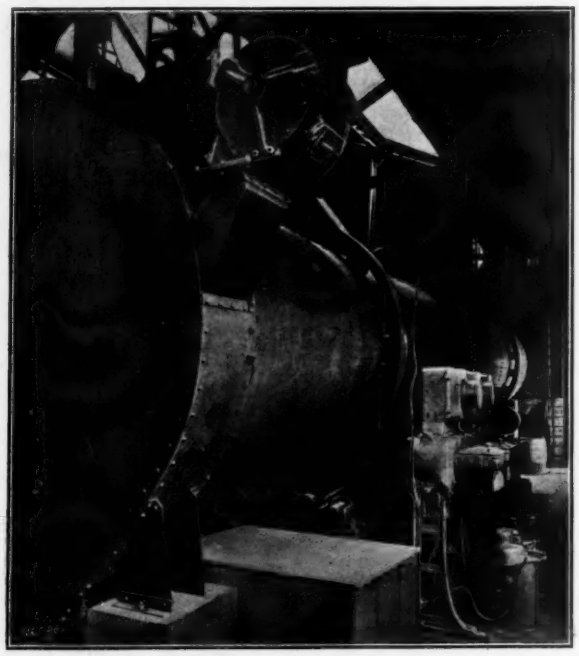


Fig. 5.—One of the Rotary Dryers.

coal on leaving the dryer is delivered by elevator and conveyor to the raw-coal bunkers in the boiler house. Originally the waste gases from each dryer were exhausted by fans and delivered to two cyclones in series. With a view to minimising the emission of fine coal into the atmosphere the cyclones have been discarded and electrostatic precipitators installed in their place. These have resulted in an appreciable saving in coal which will quickly enable the additional capital cost of the plant to be recouped.

The emission of dust from this plant is absolutely negligible, and a rough test has shown that the efficiency of the plant is over 99.0 per cent. The following capacity data concerning each dryer are of interest:—

Total Moisture Content of Raw Fuel.		Capacity of Dryer in Tons per Hour.
20%	...	12
15%	...	18
10%	...	24

Total moisture content of dried fuel is 1½%.

Normal temperature of ingoing drying gases entering inner shell is 1,000° F.

Normal temperature of ingoing drying gases entering annular space is 700° F.

Normal temperature of outgoing drying gases is 175° F.

The drying gases are obtained by burning pulverised fuel in a combustion chamber adjacent to each dryer, the fuel being delivered from the pulverised-fuel bunker in the boiler house by a current of air from a special pulverised-coal fan. This arrangement obviates the provision of pulverised-fuel storage in the dryer house.

Four air-swept ball-mill-type pulverisers are installed, each capable of pulverising 12 tons of coal per hour (see fig. 7). Each mill consists of a cylindrical steel casing, approximately 12½ ft. long by 7 ft. in diameter, fitted with manganese-steel liners. The casing is charged with 17 tons of hard-steel balls, having at the outset diameters of 50 and 40 mm. The casing is carried on large trunnions and is rotated through reduction gearing at 21 r.p.m. by a constant-speed motor. When the coal has been pulverised to the requisite fineness, a specially designed exhauster fan picks up the coal and delivers it through a separator to a cyclone, the oversize being trapped by the separator and returned to the mill. The return trunk from the cyclone is divided and delivers the air to the inlet and outlet ends of the mill in quantities determined by a series of dampers in the system, so that the air stream sweeping the mill can be regulated to give the correct fineness of the product.

When the total moisture in fuel fed to the mill does not exceed 1½ per cent. the analysis is as follows: on a 100-mesh sieve, not more than 5 per cent.; on a 150-mesh sieve, not more than 15 per cent.; on a 200-mesh sieve, not more than 20 per cent.; and through a 200-mesh sieve, not less than 80 per cent.

These degrees of fineness can be maintained for 5,000 hours at full working load, with only an occasional addition of balls and without renewals of wearing parts of the mill. The grinding balls over a lengthy period showed a loss of only 2.8 oz. per ton of coal milled. Mills having pulverised 60,000 tons of fuel each have not required any renewals of the lining plates. Experience has shown that this type of mill, though more expensive in prime cost and power consumption than some other types, is, due to its being a low-speed machine with no internal working parts requiring lubrication, very economical in upkeep and extremely reliable in operation.

From the mill the fuel is taken by air to the cyclone collector, the air returning from this to the mill. The air system forms a practically closed circuit, being vented only to the combustion chamber, and thus eliminating any dust nuisance. From the cyclone collectors the pulverised fuel is taken direct to the bunkers, but by means of two screw conveyors any bunker can be fed from any of the mills if required. There are eight bunkers, two to each boiler, each holding 50 tons of pulverised fuel. These are fitted with hand-operated mechanism to denote the height of the fuel in the bunker. It is worthy of note that although pulverised fuel has been stored for a period of five months before one of the boilers has been put into commission, and when the boilers have been laid off for protracted periods, no

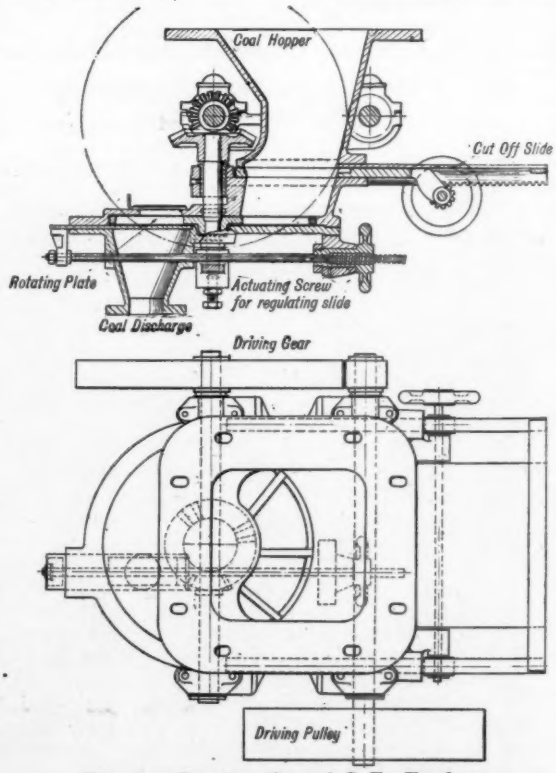


Fig. 6.—Construction of P.F. Feeder.

spontaneous combustion has occurred, the extreme dryness of the fuel, no doubt, being largely responsible for this. The inclination of the bunker sides is such that with correct drying, holding up, arching over, and/or piping of the pulverised fuel do not occur during the evacuation of the bunker.

The fuel feeders, fig. 8, are of the rotating-plate type, each bunker supplying three of these feeders. Fig. 6 shows clearly the construction of these feeders, from which the coal is delivered by gravity, assisted by a stream of inspired air to an injector in the primary-air mains, fig. 9, of which there are six per boiler, each

Fig. 7.—The Ball-Mill Pulverisers.

primary-air fan supplying three feeders. The mixture of coal and primary air is met by the secondary air, supplied by two fans per boiler, close to the mouth of the burners. The admission of all secondary air to the burners makes for the maximum combustion efficiency, minimum flame length, and simple control of air supply.

Six burners are fitted to each boiler, three at either end of the combustion chamber, the number of burners alight at one and the same time depending on the boiler load. As much as 7,300 lb. of coal per hour is passed through any one of these burners, if required. The burners have plain rectangular nozzles, but above the nozzles are cast-iron cylindrical mixing chambers designed to give a sharp change of direction from the horizontal to the vertical. In this way the maximum turbulence is achieved without sacrificing simplicity. Turbulence is also promoted after the fuel-air stream has left the burner mouth by causing it to impinge on the refractory covers placed over the roof tubes, thus splitting up the stream into jets. Experience has shown that these burners give sufficient turbulence, consistent with complete combustion, and has led to the adherence to this type of burner. The flame length is minimised by the requisite degree of fineness in the fuel, while retaining the simplest design of burner. The burners project the stream of fuel-air nearly vertically, thus giving the ash every opportunity to discharge into the ash pit instead of being carried up into the convection zone of the boiler.

Lighting up is exceedingly simple and reliable, and consists of lighting a torch and paraffin jet (operated by a compressed-air ejector) and directing it to meet the fuel stream, from the lighting-up door situated in the side of the boiler below the burners. Parry steam blowers are installed on the boilers, and these keep the boiler passes free from bird-nesting. These blowers are operated by saturated steam at boiler pressure, and the nozzles are of such a design as to convert the full pressure of the steam into velocity, thus setting up practically no excess pressure in the combustion chambers.

The ash falls by gravity into two 18-in. diameter semi-circular water-swept troughs, which are lined with cast-iron. These convey the ash to a settling pond from which it is removed by an overhead grab running on a telpher and discharged into barges. The circulating pumps draw off the clarified circulating water from the settling pond and recirculate the water around the system. The water is clarified by means of decantation in the settling pond, from which the water passes out through a sieve.

With correct proportioning of air and coal remarkably good combustion is obtained, as is evidenced by the absence of combustible matter in the chamber ash.

A certain amount of combustible matter is inevitably carried over into the flue dust, but the percentage is normally below 0.7 per cent. of the total fuel burnt in the case of the boilers with covered tubes, and 0.9 per cent. with the bare tubes. The maintenance of steady CO_2 at varying loads is a very valuable feature of pulverised-fuel plant, especially in a large power station, and is an advantage not possessed by chain-grate stokers. With the above mentioned chamber the ash which is recovered in the chamber is all in the powdered form. Another advantage with the bare-tube combustion chamber is that normal loads and overloads can be maintained for indefinite periods at 17 per cent. CO_2 without any deleterious effects on the chamber or boiler. In lighting up from cold in the case of emergency a boiler can be put on the range in 30 minutes. Great flexibility in the running of the boilers is attainable between light and heavy loads, the response to steam demand being almost instantaneous. This is a great advantage of pulverised-fuel firing in a power station, and one of which its rival, the mechanical stoker,

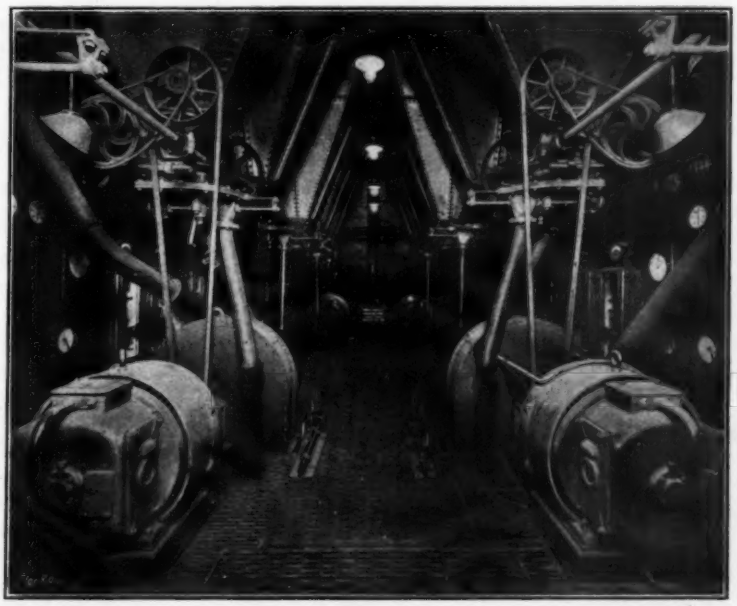


Fig. 8.—Control Platform, showing P.F. Bunkers and Feeders.

is incapable. The following instruments are provided for each boiler; steam-pressure gauge, superheat temperature recorder, Bailey steam-air-flow recorders, temperature recorders for boiler and economiser exit gases, Kent steam-flow meters, feed-water temperature recorders at inlet and outlet economiser, and draught gauges for

the combustion chamber, boiler, and economiser outlets.

The draught for each boiler is provided jointly by two induced-draught fans and a "Pratt" chimney. The plant was designed to produce a draught at the entrance to the chimney of 1.8 in. at normal load, with 78,500 cu. ft. of gases per min., and 2.75 in. at overload, with 100,000 cu. ft. of gases. The induced-draught fans draw the chimney gases through two Davidson grit catchers of the shunt suction type arranged in parallel.

On a 54-hour official test at an average rating of 140,620 lb. per hour, the overall efficiency of the plant, after deducting coal used for drying, and all power consumptions, was 81.1 per cent. gross and 84.75 on the net lower calorific value, while the combustion heat efficiency alone, including the superheaters and economisers, was 84.69 and 88.46 per cent. on the gross and net calorific values, respectively. 84.69 compares with a stoker-fired boiler combustion efficiency of 80 per cent. obtained under similar test conditions. The same figure, though a test figure, is obtained regularly during normal operation of the plant, and therefore compares actually with a boiler-house combustion efficiency of 72 per cent., covering the operation of stoker-fired boilers. The complete test figures are appended.

As evidence of the reliability and efficient operation attainable with correctly designed plant, it may be mentioned that the first boiler converted to bare tubes has now run continuously, carrying a daily overload, except for routine week-end shut-downs for a period up to date of eight months. Another point which should be mentioned is the small number of men employed to run the installation, bearing in mind the size of the plant and the various operations in connection with it.

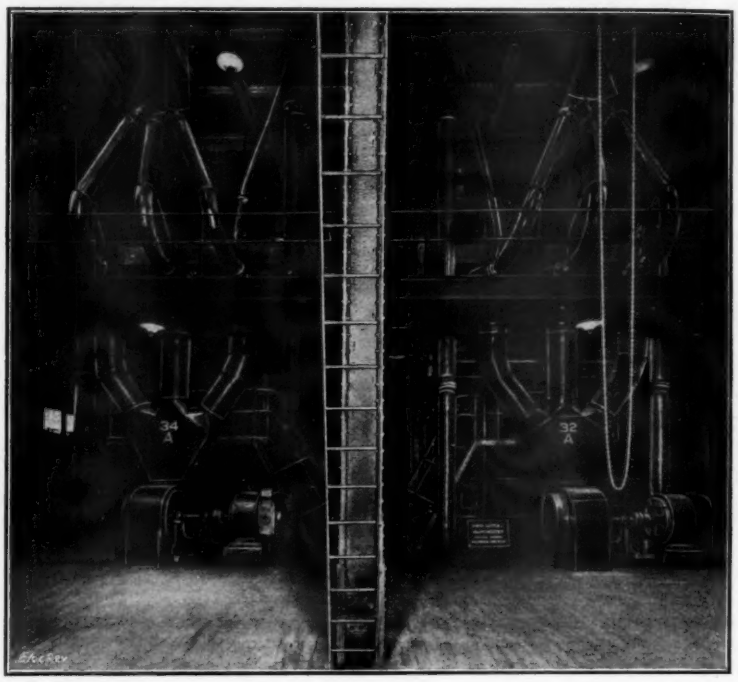


Fig. 9.—Primary and Secondary Air and Fuel Pipes.

Test Data.

Power used on the Plant.—Electrical energy used per ton of coal handled and delivered to fuel burner.

By pulveriser mill at full load ...	14.0	kWh
By fuel-collecting and conveying-apparatus	0.03	,,
By fuel feeders to the burners ...	2.7	,,
By coal-drying apparatus	2.44	,,
By other apparatus	1.38	,,
	20.55	,, per ton

Duration of test—steaming hours ...	53 hr. 40 min.
Normal duty of boiler	150,000 lb./hr.
Overload duty of boiler	180,000 lb./hr.
Average duty during test	140,620 lb./hr.
Coal as fired :—	
Moisture	3.53 %
Ash	21.56%
Gross calorific value per lb. ...	10,062 B.th.u.
Coal fired per hour	21,231 lb.
Water :—	
Evaporated per hour	140,620 lb.
Evaporated per lb. of coal (actual)	6,623 lb.
B.th.u. per lb. of steam above feed temperature	1,286.6
Temperatures :—	
Air to furnace	60.0°F.
Gases leaving boiler	683.6°F.
Gases leaving economiser	425.8°F.
Water to economiser	160.0°F.
Water to boiler	259.7°F.
Superheated steam	782.8°F.
Pressures :—	
Boiler	322.3 lb./sq. in.
Superheater	317.1 lb./sq. in.
Draught :—	
Combustion chamber (top of) ...	Plus 0.03 in. water
Leaving boiler	Minus 1.6 in. water
Leaving economiser	Minus 1.92 in. water
Analysis of gases :—	
CO_2 leaving boiler	14.59%
O_2 leaving boiler	4.57%
CO leaving boiler	0.03%
CO_2 leaving economiser	13.51%
O_2 leaving economiser	5.74%
CO leaving economiser	0.03%

Heat account :—

Heat absorbed by boiler and superheater	78.12%
Heat absorbed by boiler, superheater and economiser	84.69%
Loss in dry gases	9.52%
Loss in water vapour	4.92%
Loss in radiation, combustible ash, and unaccounted for	0.87%

Diesel Engine Progress in U.S.A.

According to the American editor of the *Financial News*, there are now 45 manufacturers in the United States making Diesel engines, although competition is at the moment so strong that it is believed only a few concerns are working this department of their business at a profit. There is now a total of about 2,000,000 Diesel horse-power at work in the United States, according to a study made by the Standard Statistics Co. In 1928 production of new engines reached 440,000 horse-power, and of all the Diesel power now used in American industry, 20 per cent. is in electric power stations, 25 per cent. in the petroleum industry, 25 per cent. in marine uses, and 30 per cent. in manufacturing, portable and excavating machinery, &c. In the south of America, where fuel oil is cheap, but where electricity costs about 2½ cents per kilowatt-hour, it has been found that electricity can be produced with Diesels for 1 cent per kilowatt-hour. A number of central power stations are installing Diesels for emergency power, and also to be used during peak-load hours. There are now 40 Diesel locomotives on American railways, mainly of the electric generator type, having a maximum speed of 30 miles an hour.

Are We Running Dry?

Some Considerations Regarding the Amount and Location of the World's Power Resources.

By D. J. BOLTON, M.Sc.(Eng.), M.I.E.E.

SPECULATION as to the possible exhaustion of the world's power resources has always had a peculiar fascination. Every year about fifteen hundred million tons of coal, oil, and other consumable minerals are dug up from the earth and burnt. Their latent chemical energy, which has been thousands

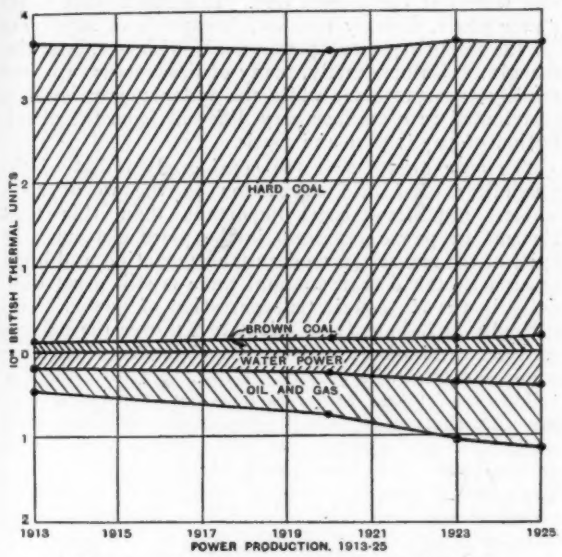


Fig. 1.—The World's Power Production.

of years in the making, becomes in a few seconds turned into heat and dissipated for ever. Such a process clearly cannot go on indefinitely. There is only a certain amount of coal and oil in the earth, and it is not being added to in any appreciable degree. Moreover, even of this total, some can only be obtained with great and increasing difficulty.

It is therefore not surprising that questions of the inevitable final exhaustion of the earth's mineral wealth should have occupied the minds of thoughtful engineers from the very early days of fuel getting. In scientific circles prophecies regarding the end of the coal and oil supplies hold somewhat the same position as phophecies about the end of the world hold in religious circles. In fact, so far as engineers are concerned, the end of the power resources *is* the end of the world—*their* world that is. No doubt the race could continue to exist by reverting to a more primitive mode of life and with a very much smaller population, but engineering, and in fact civilisation as we know it, would cease to exist, since there would be no leisure or relief for anyone from grinding physical toil. Moreover, just as there have been fervent religionists who have foretold a rapidly approaching end to the world, and have even determined the day and the hour, so there have been scientific alarmists who have foretold the rapid exhaustion of our power supplies. Fortunately in this case we depend on something more exact than the hopes and fears of human credulity, and, although wild shots have been made, data are now accumulating for a tolerably accurate forecast.

In a recently published book, *Power Resources of the World*, compiled by the World Power Conference, all the existing data on the subject of world power resources have been reviewed, and much of it reprinted in convenient and accessible form. The figures utilised below are those published by the American Bureau of Mines (Fig. 1) and the Dresdner Bank (Figs. 2 to 4). Both sets of figures are reprinted in this book, which also compares and criticises the methods of estimation employed by the various authorities.

The three main sources of power are coal, oil, and water. With the oil it is convenient to group the sources of natural gas, which are found in many places. With the coal may be included not only hard coal, but also brown coal, shale, &c. In order to give some idea of the relative importance of these three, it may be said that at present three-quarters of the world's power and heat comes from coal, 15 per cent. from oil, and only 5 to 8 per cent. from water. This last figure is in some doubt, since there are various ways of estimating water power and of comparing it with coal and oil. The authorities here illustrated give the higher figure, but there are reasons for believing this estimate too high. In any case it will be seen that, although oil and water power have increased, and are increasing rapidly, they still account for only a quarter of the total, and there is no prospect whatever of their ousting coal from the premier place.

Dealing first with this question of annual power production, fig. 1 has been prepared to show graphically how this has varied in recent years, and also to show the proportions of the different groups. In this figure the various sources of power have all been brought to a common basis of calorific value. Coal is plotted above the horizontal zero line and is divided into hard coal and brown coal. Oil and water power are plotted below the line, and the vertical width of each belt represents the magnitude of that group in heating power. The outstanding feature of coal is that the total world

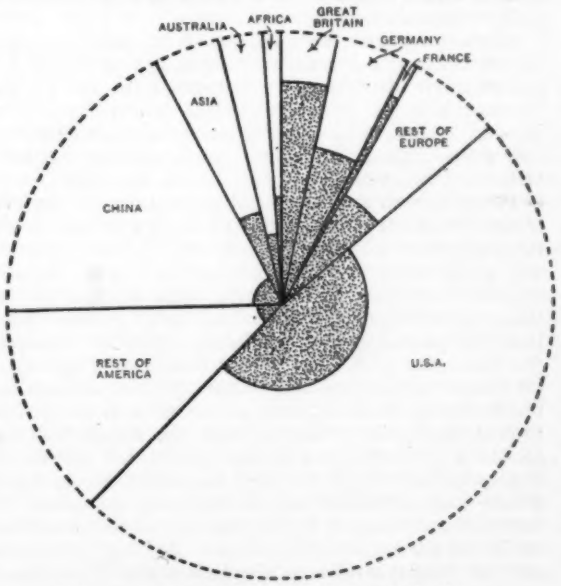


Fig. 2.—Coal Resources and Production.

production has been practically stationary since 1913. This does not apply to soft coal which, as will be seen, only represents a very small item as compared with the hard coal. Oil and water power have increased steadily, and each of them has more than doubled in the period shown.

Turning now to the question of future resources,

estimates differ widely, and in some cases it is very difficult to make more than a rough guess. The conclusion of the book referred to above, after an exhaustive review of existing data, is that further reviews are necessary in the case of very many of the fields. In several instances two or more estimates are available which differ so much that it is difficult to attach much value to any of them. Nevertheless, some tentative conclusions can be drawn. In the case of coal the world's total coal reserves are estimated at some five billion

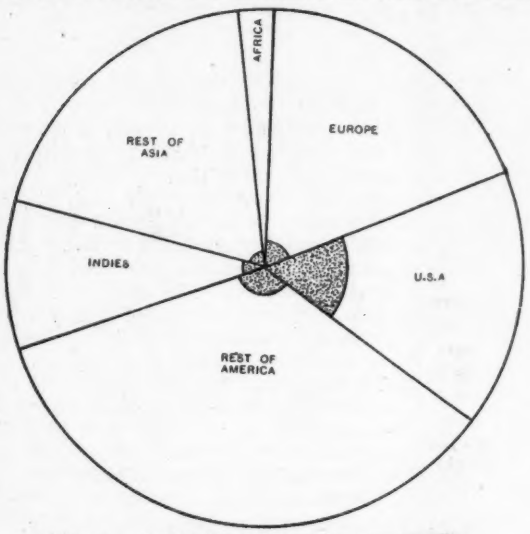


Fig. 3.—Available Oil and its Production.

tons, which is something over four thousand times the present annual rate of consumption. Even assuming that some of this coal cannot be won without excessive labour, there still appears to be very little cause for immediate anxiety. It would seem, in fact, that, as regards coal, the end of the world is not very close at hand, and apparently, like Mark Twain, the reports of its death have been much exaggerated!

In fig. 2 the estimated coal reserves for the whole world are represented by the area of the large dotted circle, and this is divided up beween the different continents and more important countries. The darkened central areas in each case represent annual production to 500 times the scale.

Considering next the question of oil resources, here the situation is not quite so promising. Not only are the resources much less in proportion to the annual consumption, but this consumption is rapidly on the increase. However, even here things are not so bad as they are sometimes made out, and it appears that some of the published estimates owe more to the heat of propaganda than to the pure cold light of science. In fact, if certain reports regarding the U.S.A. are to be believed, the total resources there are only two or three times the annual production! Making use of more reliable estimates, and taking the world over, it appears that the total surveyed resources amount to some forty times the present annual production. If these estimates are final, and if the production continues to go up at its present rate, there will be a very drastic check and readjustment of the world's power methods within the present generation. This applies not merely and not so much to large-scale power production as to the smaller units, and particularly to road transport. But whilst these estimates are the best now available, the experience of the past is that new sources are discovered as fast as the old ones become exploited, and it may be that in forty years' time the estimate will still stand at forty years ahead!

In fig. 3 the area of the outer circle represents total oil resources and the inner darkened sectors represent annual production to the same scale. These areas are divided up radially as before into the different continents, &c. It will be seen that it is only in the U.S.A. that the rate of exploitation gives any immediate cause for alarm. As regards the very large deposits in other parts of America, in Asia, and in Europe, the rate of exhaustion is still quite small.

Dealing finally with the question of water power resources, fig. 4 shows these to the same scale as the previous figure. As before, the outer circle represents total potential resources, whilst the inner blackened sectors show the extent to which these resources have been realised. At first sight the position here may appear more serious than in the case of the other two, since the potential resources are less and the degree of realisation is greater. But it must not be forgotten that the potential resources in this case are *annual*, not total. The inner black areas could expand until they filled the total outer circle, and the power developed could be maintained *every year* at this rate. In the case of coal and oil, the outer areas represent total resources, and once these are completely realised they are exhausted for ever.*

It is interesting to note that the potential annual water-power resources represent about 25 per cent. more than the total annual power production (coal, oil, and water) at the present day. This means that water power alone, if fully realised, is capable of supplying all the world's present power needs with a substantial margin. Unfortunately, many of these needs are not readily transportable, while the water power itself is distributed in a manner very different from the distribution of population and needs.

The only question so far considered is that of the possibility of future exhaustion in the world as a whole. But almost more important than this time element in power resources is the place element. In spite of the marvels of modern transportation and high-tension electrical transmission, there is still great difficulty in the large-scale transportation of power. This difficulty is frequently sufficient to tip over the balance of trade and divert orders into channels which they would not otherwise occupy. When, therefore, the distribution of power resources does not correspond with the distribution of either population or industrial needs, the fact is important and possibly vital to the future peace and development of the world. In the past, the densest populations have chiefly grown up either where the living requirements are easy, as in Asia, or where coal is plentiful and readily accessible, as in Central and Northern Europe. In these centres have developed characteristic civilisations, the one agricultural and the other industrial. Now that coal fields are being developed in fresh areas, and that other forms of power are becoming available, a new orientation emerges and may become inevitable. We natives of Europe and the North American continent have generally regarded ourselves as the hub, at least of the industrial universe, and it is somewhat mortifying to discover that much of the world's potential power resources lie outside our areas.

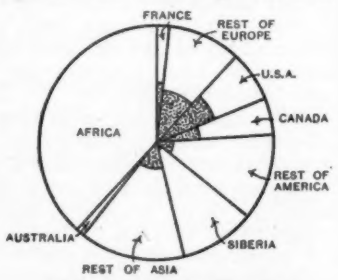


Fig. 4.—Water Power Resources and Use.

Finally, whatever our politics or point of view, whether imperialist or humanitarian, we shall at least agree as to the vital importance of a scientific study of the world's power resources. With a sane and ordered exploitation and utilisation, it is possible for the vast riches of the earth to yield a fruitful legacy for every one of its inhabitants: the legacy of a standard of living and leisure hitherto unknown. If it becomes a mere game of grab, a tug of war between rival combines and narrowly conceived personal interests, these same riches may be fought over and squandered, leaving nothing but extravagance for the few and misery for the many. The first step is to survey and study.

* As regards the scales of figs. 2 to 4, a given area represents a given number of tons or equivalent tons per annum. The same scale is used for all parts of figs. 3 and 4 and for the centre portions of fig. 2. The outer part of fig. 2 is 1/500th of this scale, and is therefore dotted.

The G.I.P. Railway.

Electrification of the main lines from Bombay to Poona and from Bombay to Kalyan: the lines traverse difficult mountainous country and constitute the most extensive railway main-line electrification scheme within the British Empire.

(*Concluded from page* 896.)

Locomotives.—With steam operation it was usual to haul the longest possible freight trains from Bombay to Karjat or Kasara, and to break them up at those points into smaller trains which could be conveniently worked over the Ghats. Electric trains are made up of such a weight that they can be hauled right through without remarshalling, the maximum loads being fixed at 1,000 tons from Bombay and 1,600 tons towards Bombay. Steam locomotives will be retained for some of the shunting and the marshalling of trains.

On the Ghats two electric freight engines are used, each capable of exerting a tractive effort of 50,000 lb. (on test up to 85,000 lb. was exerted), but elsewhere only one is required. The design provides for six driving axles, there being two trucks each with three coupled axles. The two trucks are pivotted and are also joined together by means of a flexible articulated coupling. The length over buffers is approximately 66 feet, the rigid wheel base 15 ft. 1 in., and the wheel diameter 48 in. There are no carrying axles, and the total weight which is rather more than 120 tons is all available for adhesion.

Each truck contains a pair of motors geared together on to a single intermediate jackshaft. The power is transmitted from the jackshaft to the road wheels by means of connecting rods. The total horse power of the four motors in each locomotive is 2,600. The motor bearings are of the ring lubricated type, and their operation has so far been particularly successful.

There is a driver's compartment at each end of the engine, but, except for master controllers and a few small switches, the whole of the control equipment is housed in a high tension compartment in the middle. The control is of the electro-pneumatic type and the four motors can be grouped in series, series-parallel, or parallel, thus giving speed combinations of one-half, three-quarter, and full speed. With two stages of field control, there are in all nine economical running positions in addition to starting notches. The control has been arranged for regenerative braking; by this means the excessive wear which used to take place on the rails and also on the tires and brake blocks when coming down the Ghat gradients will be very considerably diminished. Each engine can exert a retarding effort up to 45,000 lb.

The braking system adopted is a combination of the vacuum and compressed air system. The brakes on the engine are actually applied by compressed air, but the flow of air is controlled by the movement of the same vacuum brake handle which applies the vacuum brakes on the train by means of a proportional valve.

Forty-one freight engines were ordered from the Metropolitan-Vickers Electrical Co., Ltd., the mechanical parts of the first 10 being built by the Swiss Locomotive Machine Works, and the remaining 31 to the same design by the Vulcan Foundry. The engines were despatched in parts, and were erected at the railway workshops at Parel. More than half of the engines are now in use, a large number of them having been in satisfactory service for more than a year.

In order to ascertain the best type of passenger engine for the conditions prevailing in India, three different types were ordered, one each from the Metropolitan-Vickers Electrical Company, the British Brown-Boveri, Limited, and the General Electric Company, Ltd.

Exhaustive tests were made in 1928 by the chief mechanical engineer and Messrs. Merz & Partners, and the order for the remaining 21 engines was placed with the Metropolitan-Vickers Electrical Company. All the engines were erected at the railway workshops at Parel.

The tests showed the engine to ride without oscillation at speeds up to 80 miles an hour, with riding qualities that were equally good in either direction.

The passenger engine is unsymmetrical, there being two carrying axles at one end and one at the other. The weight of the superstructure is transferred to the bogie truck through a fore and aft equaliser with hemispherical pivots. The single carrying axle at the other end is combined as a truck with the adjacent driving axle, the arrangement being known as a "Java Truck." The flexibility in the driving mechanism between the motors and the axles allows the driving axle to follow the movements of the truck, notwithstanding that the motors are mounted in the superstructure of the engine. The angular movements of the trucks are spring controlled.

The total weight is 102 tons, of which rather more than 60 tons is on the three driving axles. The weights on the axles are equalised into two groups, the two bogie axles constituting one group and the three driving axles and pony axle the second. The length over buffers is 53 ft. 6 in. and the rigid wheel-base is 7 ft. 6 in., *i.e.*, the distance between two driving axles. The driving wheels are 63 in. diameter and the carrying wheels 43 in.

Each engine has six motors of the total horse power of 2,160. Each driving axle is driven by two motors mounted in line across the engine with their pinions driving separate gears on a common intermediate shaft. On the centre of this intermediate shaft is a spur wheel, which gears directly to a further spur wheel encircling the driving axle, but carried in bearings which are part of the frame of the engine. Between this encircling spur wheel and the axle are links which give a flexible drive of uniform angular velocity. This arrangement reduces the unsprung weight to a minimum, and allows the motors to be placed in a position where they are readily accessible and raises the centre of gravity of the engine, a feature of special importance for smooth running at high speeds.

The control is electro-pneumatic, as in the case of the freight engines, but no regenerative braking is provided, as trains ascending and descending the Ghats will be assisted by freight engines. Since there are six motors, the speed combinations will be one-third, two-thirds, and full speed, but the use of the two field taps provided will permit variations on these so that there are in effect nine economical running speeds. The characteristics of the motors enable them to share the loads properly with the freight engines when hauling trains together over the Bhore Ghat. Passenger train engines will not be required to go over the Thull Ghat, all trains being dealt with on this Ghat by freight engines.

A driving cab is provided at each end with a central gangway down the middle of the engine. The high tension apparatus and the resistances are housed in separate compartments on either side of the gangway. The resistances are cooled by natural ventilation.

An All-Electric Country House.

"The Bungalow," Frensham Heights, Surrey.

SELDOM, if ever, is electricity used in the home upon such a generous scale as it is in the residence of Mr. P. S. Douglas-Hamilton, "The Bungalow," Frensham Heights, Surrey. This modestly-named place comprises about 40 rooms and is beautifully situated on the Surrey - Hampshire border about three miles from the town of Farnham.

We are not competent to speak with authority upon its architecture, but we may say that it has an extremely pleasing appearance (as will be judged from the view in fig. 1) and is very well laid out. It was built by Messrs. H. Field, of Frant, Sussex, under the supervision of Mr. H. A. Hooker and to the neatly compact design of Mr. L. S. Hatchard, of Tunbridge Wells.

Fig. 1.—"The Bungalow," Frensham Heights.

The electrical installation provides a total load of about 120 kW, and energy is supplied by the Farnham Gas & Electricity Co. at 2,000 V 3-phase, the supply being stepped down to 230 V in a transformer station in the basement of the house. Probably the most remarkable feature of the installation is the switch-room which adjoins the transformer room. So far as possible the load has been evenly distributed between the three phases. The main switch-fuse is an "M.E.M." three-pole pattern designed for 200 A per way. The water heating and cooking main switch-fuse is of William Sanders & Co.'s manufacture, arranged for 60 A per pole. The lighting is controlled by a Berry "Viking" switch-fuse, and Ferranti meters are employed on each phase.

A large part of the load is due to the "Unity" tubular heater system (Young, Osmond & Young, Ltd.), which is employed in all the rooms, corridors, &c. In every position the heaters are controlled by "Satchwell" thermostats which can be set to act over a wide range of temperatures. The result is a very uniform and constant temperature throughout the house, and although the total loading of the tubing installed is about 37 kW, this is, of course, not constantly in action. The tubes vary in length from 2 ft. to 17 ft. In the bathrooms and in one or two other positions heating is provided by "Morganite" 500-W panels. Those in the bathrooms are mounted near the ceiling and each has a little pilot lamp to indicate when the current is on.

The "Unity" system is supplemented in the principal rooms by "Magicoal" electric fires. There are eight of these fitted in fireplaces and some were specially designed. Various forms of heat have been provided. In some cases the elements are concealed in trivets standing in their normal position in front of the fire. In other examples the elements are situated in the flue and the radiation from them is projected forward by means of parabolic reflectors made up in the form of smoke canopies. The fires are of excellent workmanship and

Fig. 2.—The Drawing Room, showing a "Magicoal" Fire.

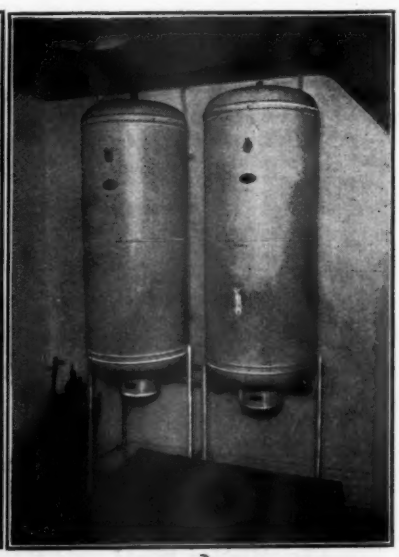


Fig. 3.—Two Large "Sadia" Water Heaters.

are designed to fall naturally into the scheme of decoration and furnishing in each room. Fig. 2 is a view of the drawing room showing one of the " Magicoal " fires. The total heating load is about 78 kW.

The " Sadia " water-heater installation consists of fourteen electric automatic water heaters, having a total storage capacity of 346 gallons, at a temperature of 195 deg. F. The total load is 21.3 kW. Each heater is controlled by its own thermostat, so that it is only on rare occasions that the total connected load comes on to the supply at one time. The heaters are arranged in positions convenient to the taps which they are to supply. In most cases, particularly for the supply to the principal bathrooms and wash basins, the heaters are enclosed in cupboards; fig. 3 shows two of the larger " Sadias " installed in this way. A separate control board is arranged in the switch room and the heater circuits are run back to it. It is thus possible to control the number of water heaters in use at any one time from a central position. The advantage of this arrangement is that for bathrooms which are used by guests and, therefore, are not required daily, the heaters can be disconnected from the supply and only put into circuit a few hours before the guests arrive. A large storage tank in the roof of the building supplies the various "Sadia" water heaters. A cold water main is run from the tank and the various feeds are tapped off from it to the heaters. The latter are constructed of plain copper sheets, which are welded together to form the containers, a special welding process being used. After test the containers are pickled, tinned thoroughly inside and outside by total immersion in a large vat of molten pure tin, and then fitted in lagged containers.

Fig. 4.—The " Hotpoint-Falco " Range.

The principal appliance in the kitchen is a large double-oven " Hotpoint-Falco " cooker (fig. 4), which the makers claim to be capable of catering for from 20 to 25 persons. The larger oven has a loading of 3,000 W and the smaller is rated at 2,000 W, each with three-heat control. There are a large 3,000-W grill and five enclosed boiling plates. The latter comprise three 8¾-in. (1,800 W each) and two 7-in. (1,200-W) plates and are all equipped with three-heat switches. The total loading of the cooker is about 16 kW, and each half is separately wired and switched. The body is black stove enamelled and the hob is blue-black vitreous enamelled. The door panels and feet are white enamelled. Each oven is fitted with a removable interior and a thermometer is mounted upon each door. Near the cooker are two plug points to which kettles, irons, &c., can be connected. In the scullery there is a " Hotpoint-Walker " dish-washer. This comprises a white-enamelled cylindrical tank in the bottom of which is an impeller driven by a small motor. The dishes, &c., are placed in a wire tray in the top of the tank and water is swirled over them at high speed. When the washing is completed the cover is taken off and the crockery is allowed to dry.

" Electrolux " refrigerators have been installed in the butler's pantry and larder, and other electrical apparatus is in use, such as polishing motors, irons and vacuum cleaners. Outlets for the last are provided at convenient points all over the house. There is also installed an " Electrolux " water softener capable of dealing with 2,000 gal. of water of 16 degrees hardness.

Every circuit in the house is brought back to the switch-room and each is separately controlled by a rotary switch and two single-pole fuses. The rotary switches are arranged on the marble panels of four totally-enclosed boards, two of which can be seen in fig. 5. The board connected in the " A " phase deals with 36 heating and cooking circuits; phase " B " board controls heating circuits, vacuum cleaner points, towel rails and six " Sadia " water heaters—36 points in all; and on phase " C " there are two panels—one controlling 27 heating circuits and nine " Sadia " water heaters, and the other 21 lighting and bell circuits. Each switch is numbered, and to facilitate the location of any switch there is a chart upon the wall of the room detailing the various apartments and their circuits, indicating the switch number for each. Next to the switch-room there is a store in which all kinds of spares are kept.

In addition to the equipment in the house the construction is well in hand of an electrically-heated greenhouse. This is a triple structure of large dimensions in teak and " Vitaglass." Here, again, the " Unity " system of heating is to be employed. The equipment will be under thermostatic control operating three-phase contactors.

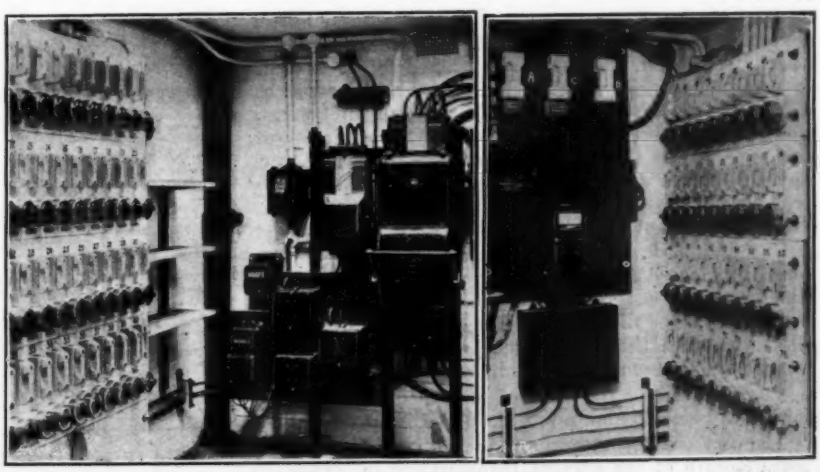


Fig. 5.—Two Views of the Switch Room.

The whole of the electrical work has been carried out by Messrs. F. H. Wheeler, Victoria Street, S.W.1, with the assistance of their engineer, Mr. A. Hulks.

In conclusion, we would express our indebtedness to the owner for his courtesy in permitting a visit of inspection and acting as our guide. Mr. Douglas-Hamilton tells us that when reasonable allowance has been made for the wages of a stoker, the cleanliness, and convenience, there is very little difference between electric and coal heating in the matter of cost.

Feeder Protection.

A Comparison Between the Effectiveness of the Merz-Price and "Translay" Protective Systems.

By G. R. M. GARRATT, B.A.(Hons.) Cantab.

IN many respects the adequate protection of feeders represents greater difficulties than the protection of individual pieces of apparatus. Whatever form of protection is used for single pieces of equipment, the relay circuits and pilot wires are all short, and accidental tripping, due to capacity currents or to faults on the pilot wires themselves, is most unlikely. Feeder protection, on the other hand, calls for very careful consideration of the constants and construction of the pilot wires and all associated gear, and it may be said that, though numerous attempts have been made to produce a perfect system of protection for feeders under all conditions of load, the attempts have been only partially successful.

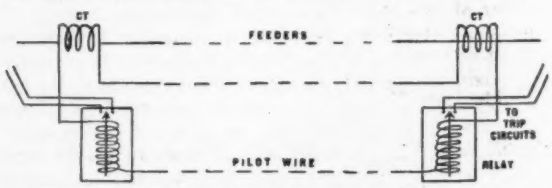


Fig. 1.—Simple Merz-Price Protective System.

The usual method of protection adopted for feeders operates on the Merz-Price principle. Fundamentally, Merz-Price protection compares the current entering a feeder with the current leaving it. Under fault conditions, the two currents will not be identical, and the difference is used to operate relays, which, in turn, trip out the faulty sections.

In practice, current transformers are connected at each end of the feeder (fig. 1). The secondary windings of the current transformers are connected together by means of pilot cables in such a way that the e.m.f.'s generated oppose each other. If the feeder is in a healthy condition, the e.m.f.'s generated in the current transformer secondaries at each end of the feeder will be equal, and no current will flow through the pilot wires. Relays are connected in series with the secondaries at each end of the feeder. Under fault conditions, the opposing e.m.f.'s do not balance, and the resulting current operates the relays, which, by means of the circuit breakers, trip out the faulty section.

Unfortunately, in practice, this system possesses several serious defects. They have all been attacked in different ways, but almost every solution of one problem introduces other difficulties. The defects of Merz-Price protection and the various methods used to overcome them may be summarised as follows :—

(1) Failure of the pairs of current transformers to maintain perfect balance under all conditions of load.—

The very strictest attention to detail is required in the manufacture of the current transformers in order to make certain that they contain exactly similar weights of iron of identical grade. The construction of the core and its joints, and the insulation of the laminations, must receive the most careful attention to insure that correct balance will be maintained, even up to many times full-load current. Incorrect balancing at large overloads is a possible cause for incorrect tripping at times of "through faults." On such occasions, a perfectly healthy feeder, called upon to supply a heavy overload current to some other faulty section, may be disconnected in error.

In addition to the use of very carefully balanced current transformers, a further precaution against accidental tripping on heavy overloads, or through fault conditions, is to give the relay a bias which varies in proportion to the current in the main feeder. This bias is arranged to increase the fault-current setting of the relay. At times of heavy overload, any small out-of-balance current which may exist, due to slight differences in the characteristics of the current transformers, will be insufficient to operate the relays, though a true fault on the feeder itself will still cause perfect operation, since large out-of-balance currents then exist.

(2) Unjustified tripping, due to capacity currents in the pilot cables.—

Under all normal conditions there exists a difference of potential between the two wires of the pilot cable. The inter-capacity of these is often of a large order, and the charging currents must flow through the relay coils. Under healthy conditions these charging currents will be considerably less than the settings of the relays, but, with heavy through fault currents in the feeders, the potential difference in the pilot wires will rise very considerably, and the charging currents may then be sufficiently large to operate the relays.

The only satisfactory method of combating this difficulty lies in the use of specially sheathed pilot cables. In such a cable each of the pilot wires is surrounded by a copper sheath, which is insulated from the wire and also from earth. At some point along the cable, usually approximately in the centre, the sheath is broken. The ends of the two halves are then connected between a relay and a current transformer, so that the charging currents flow through the transformer secondary, but not through the relay. In practice the use of these specially sheathed cables has proved perfectly satisfactory, but the cost is 40 per cent. to 50 per cent. above that of an unsheathed cable.

(3) Accidental tripping due to surge currents in the main feeders.—

Generally, the inter-capacity of the feeders themselves is of a low order, and charging currents will, therefore, be of too low an order to operate the protection gear. With very long feeders, however, this is not always the case, and transient charging currents, due to a voltage surge, may momentarily produce the effect of an actual fault on the feeder. Owing to the capacity of a feeder being a distributed one, a charging current must obviously be greater at the "near" end than at the "far" end. A voltage surge is generally caused by a momentary fault on the system; a drop in voltage results, and as the fault clears the voltage may rise again

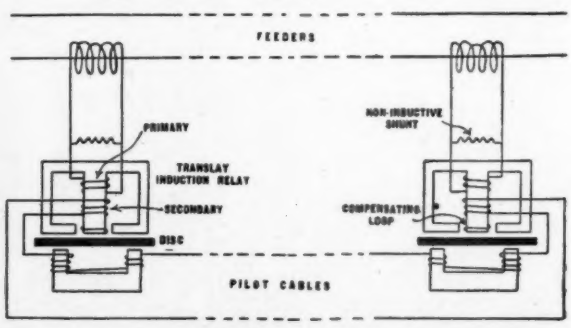


Fig. 2.—"Translay" Protection on Single-phase Feeder.

very suddenly. Extra heavy charging currents are caused thereby in the feeders, and on a long line where the capacity is above the average they may be large enough to operate the relays.

Under surge conditions the charging current usually has a high frequency. The coils of the relays are highly inductive, and it is therefore possible, by connecting a non-inductive resistance across the relay coils, to by-pass the high-frequency charging currents. This method unfortunately reduces the sensitivity of the relay in ordinary operation, and, in any case, the fault current settings have to be sufficiently high to prevent operation on the fraction of high-frequency current which may pass through the relay itself.

(4) High fault current settings required, due to impedance of current transformers and pilot wires.—It must be remembered that *all* the power available for relay operation has to pass through the current transformers and the pilot wires, and the impedance of these necessarily implies a comparatively high fault-current setting. The use of special super-sensitive relays largely overcomes this difficulty, but relays operating on only 0.02 VA cannot be either so robust or so reliable as a relay of more common design operating on 2 VA or more.

It is therefore seen that in practice Merz-Price protection, though perfectly satisfactory up to a point, does suffer from certain serious defects. These defects, though they can be minimised in the various ways indicated above, must always be present to a greater or less extent, and the incorrect switching which takes place as a result is a frequent source of worry and anxiety to the engineer.

A system has recently been developed which does not possess in practice any of the disadvantages of Merz-Price protection; it is known as the " Translay " protection system, and a brief description of it may not be out of place.

The relays used in Merz-Price protection are usually of the electro-magnetic type, operating with a plunger or a moving armature. The " Translay " relays are of the induction pattern, and instead of operating almost instantaneously, as is the case with the electro-magnetic type, they have a slight " inverse time " delay. This brief time delay is introduced by magnetic damping, and in practice is an advantage over the instantaneous type, since it gives stability under transient " through fault " conditions which are frequently the cause of incorrect operation by the M-P system. The time delay on a serious fault is only of the order of 0.1 second, and it will therefore be appreciated that under true fault conditions the delay is not disadvantageous, whereas under transient circumstances the added stability is an enormous advantage.

Fig. 2 illustrates the principles of operation of a " Translay " relay in the case of a single-phase feeder. The trip contacts and associated circuits have been omitted to simplify the diagram. It will be seen that the secondary windings of the current transformers are connected to a primary winding in the relay. Coupled with the relay primary is a secondary coil, and it is the induced e.m.f. in this secondary coil that supplies the current for circulation through the pilot wires and operating coils of the relays. The secondary coils of the relays at either end of the feeder are connected in opposition, and under normal conditions no current will flow through the pilot wires. Under fault conditions, however, the balance will be disturbed and a current will flow through the operating coils. The magnetic flux thus produced will react with the leakage flux from the top element and cause rotation of the disk, thus closing the trip contacts.

Since the relay itself acts as a transformer, it is unnecessary to use specially balanced current transformers, as the balancing can be done in the relay. Indeed, this is actually done in practice, and it is therefore possible to use ordinary current transformers instead of the very carefully balanced ones required with other types of balanced protective gear.

It will be observed that the leakage flux from the top electro-magnet leads the flux from the operating coil by nearly 90 deg., and it is this phase difference which causes rotation of the disk.

One of the most serious disadvantages of the Merz-Price system is the frequent operation on transient charging currents in the pilot cables, but in the " Translay " system incorrect tripping due to this cause does not occur. It will be appreciated that charging currents in the pilot cables lead the pilot voltage by nearly 90 deg., and the current through the operating coils of the relays is therefore approximately in phase with the leakage from the electro-magnet. No rotation of the disk will therefore occur. In actual practice a compensating loop is fitted to the electro-magnet to adjust the phase of the leakage flux, in order to insure that the two fluxes shall be as nearly as possible in phase when capacity currents are flowing in the pilot wires.

It is therefore possible to dispense with the use of specially sheathed pilot cables, and further, owing to the saturation of the magnetic circuit, it is not even necessary to use pilot cables insulated for a high voltage, since the maximum potential difference which can exist, even under heavy through fault conditions, is only of the order of 100 volts.

Incorrect operation of the relay, due to transient charging currents in the main feeders, is prevented by the provision of a non-inductive shunt connected across the highly inductive electro-magnet. As was explained above, these charging currents have a high frequency and will take the non-inductive path rather than the path through the relay coils. The objection to the use of a shunt, that it seriously increases the fault-current setting of the relay and thus reduces its sensitivity, does not apply to the " Translay " relay, since fault-current settings very considerably lower than full-load current in the current transformer can be obtained. It must be remembered that, unlike the electro-magnetic type of relay, the whole of the power for operation of the relay does not have to pass through the pilot wires, since the torque for operation is dependent on the interaction of the local flux with the flux due to the current in the pilot wires. A high torque is therefore obtainable with but a small current in the pilot wires. This current is only of the order of 25 milliamperes, and the pilot cables can therefore be of high resistance.

In conclusion, it must be said that these notes, and particularly the description of the " Translay " system, are necessarily somewhat abbreviated, but they have been written to focus attention on what is still one of the greatest problems in e.h.p. transmission. Experience has shown that the Merz-Price system, while perfectly satisfactory up to a point, does not include perfect stability among its characteristics. The " Translay " system is an important advance, and it has proved itself to be thoroughly reliable for difficult conditions under which other systems have failed.

Delray Power Station, Detroit, U.S.A.

The first portion of the Delray power station of the Detroit Edison Co., which has been designed for an ultimate capacity of about 350,000 kW, was put into operation last August. Steam conditions at the boiler stop valves are:—Pressure, 455 lb. per sq. in.; temperature, 700 deg. F. Five 340,000-lb. boilers are now installed. A separately fired super-heater will be added in connection with the 10,000-kW B.T.H. high-temperature turbine to be installed later. Other features include the use of Underfeed stokers, water-cooled walls, and air pre-heating. The two 50,000-kW, 1,200-r.p.m. turbo-alternators are bled from four of the 21 stages. The exhaust is condensed in single-pass condensers with 60,000 sq. ft. of surface. Generation voltage is 12,200, stepped up to 24,000 by individual auto-transformers. The 250-volt exciters are directly-coupled. Supply for auxiliaries is obtained from two 4,000-kW Laval compound condensing 250-volt d.c. turbo-generators (turbines 3,000 and 4,000 r.p.m., generators 360 r.p.m.), from which steam is extracted at the fourth stage for heating the building.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The " Review " at Christmastime.

As stated in an announcement appearing in our advertisement pages to-day, certain alterations will be necessary in arrangements for the publication of the ELECTRICAL REVIEW for December 20th and 27th, owing to the Christmas holidays falling in the middle of the week. Advertisement copy and blocks for displayed announcements for our December 20th issue will require to be in our hands by next Wednesday (December 11th) at the latest, and small classified advertisements on Monday, December 16th. For the December 27th issue the corresponding dates for the receipt of advertising copy are December 16th and 23rd, respectively.

Editorial matter for the December 20th issue must be in our hands one day in advance of the usual time.

New Municipal Showrooms.

The Dumfries-shire County Council, in connection with its electricity undertakings, has opened an office and showroom at Central Avenue, Gretna, Dumfriesshire, and asks for publicity matter relating to electricity supply. The engineer and manager is Mr. C. R. Westlake.

The Morecambe Electricity Committee proposes to transfer the showrooms of the Electricity Department from the power station to Queen Street, one of the chief shopping streets of the town. The proposal has met with opposition, because the Committee recently spent £500 on the existing showroom, and the local electrical contractors are objecting on the ground that the prospective development promises an extension of municipal trading.

A Proposed Trading Register.

Reporting on the proposal for the compilation of a register for the electrical industry, containing the names of those entitled to trade terms, the Trading Committee of the Electrical Contractors' Association says that it has every reason to believe that several branches are actively pursuing the object put forward. Certain manufacturing associations are supporting the principle involved, and so far the Trading Committee has heard of no serious opposition to the scheme. It is also interesting to note that at a joint meeting with the Electrical Wholesalers' Federation recently, a resolution was submitted supporting the Register and agreeing to bear *pro rata* a portion of the cost.

The Position in America.

The New York correspondent of *The Times* says that unfortunate exaggeration of the United States President's efforts to avert a psychological decline in business has served only to advertise the decline which was in progress well before stocks collapsed, and as a result trade and manufacturing statistics are being much more closely studied than for some time past. These figures are not altogether re-assuring for those who hope for an early ending of the business reaction. Steel production, for example, has now dwindled to 68 per cent. of capacity against a normal 80 per cent. at this time of year. In the Pittsburgh district it is down to 65, and in small independent mills in the Cleveland district, which depend largely on orders from the automobile industry, it is only 35 per cent. Production of pig iron has likewise declined markedly, in spite of increased orders for iron and steel from railways and engineering enterprises, and so has the production of cotton textiles, boots, shoes, leather, and, of course, automobiles. Building operations continue their decline, and steadily falling rents in widely separated parts of the country make it seem likely that it will be some time before building will again expand, notwithstanding considerably cheaper money. Shares of copper companies were unsettled last week because of intimations that the price of the metal was likely to be reduced below 18 c., but strong export buying seemed to make that fear premature. Our contemporary also records declines in wholesale commodity prices, railway freight traffic, cereal exports and brokers' and bankers' loans.

Swiss Electrical Machinery Exports.

The exports of electrical machinery from Switzerland during the first half of the current year attained a value of £1,103,280.

The E.C.A. and the " Outlet " Campaign.

Upon the recommendation of its Finance Committee, the Electrical Contractors' Association has decided to make a grant of £500 towards the expenses of the E.D.A. Electric Homes (Outlet) Campaign, in addition to its usual contributions to E.D.A. funds.

The British Industries Fair.

Mr. E. J. Jennings, hon. secretary of the Electrical Advisory Committee of the Birmingham Section of the B.I.F., informs us that the British Electrical Development Association will occupy a central position in the Electrical Section of the 1930 Fair, and an attractive kiosk is being erected, the colouring of which will be buff, red and gold. The Committee considers it very desirable that the distinctive colours of the E.D.A. kiosk should be adopted for the various stands in the Electrical Section, and that all the exhibitors should adopt these colours. The Fair management has, therefore, made arrangements with the official contractors for red and buff to replace, where possible, and at no extra cost to the exhibitor, the usual black and white.

On Tuesday last Mr. G. M. Gillett, Secretary to the Department of Overseas Trade, announced at a luncheon organised by the Birmingham Chamber of Commerce that he was appointing a committee to examine the present situation of the Fair, and to consider means for extending its utility to British trade. This would be the first inquiry of the kind since the Warner Committee in 1921, and there were now new circumstances to consider. Lord Chelmsford would be the chairman of the new committee, and until a report was received he would ask the Government to continue its grant of £25,000 for publicity purposes.

E.D.A. Sales Conference.

A paper on " Showroom Organisation and Salesmanship in the Electrical Industry," was given by Mr. A. C. Bostel at the South Wales Institute of Engineers, Cardiff, on November 12th. Mr. Bostel said that the electrical showroom must be considered to be the best medium to convey the electrical message to the people, and the centre from which propaganda should radiate. He outlined the manner in which showroom windows and interiors should be arranged, the service expected of the showroom staff, and the qualifications which go to make a successful salesman and sales organisation.

Swedish Plant for Russia.

The Russian Commercial Delegation at Stockholm has concluded an agreement with Karlstads Mekaniska Verkstads Aktiebolag for three turbines of the Kaplan type, each of about 35,000 h.p., for the new Russian hydro-electric power station on the river Svir. A fourth turbine of the same size will be constructed according to Swedish designs at the Leningrad works of the Soviet Mechanical Trust. The same Swedish works has previously delivered eight turbines of 11,000 h.p. each for the Russian hydro-electric power station Volkhovstroy, which has been working with very good results for some years. The value of the new order, which was obtained in keen competition with German and Swiss works, is Kr. 3,700,000. The hydro-technical planning of the new Russian power station was carried out by Swedish engineers belonging to the Vattenbyggnadsbyraan (Hydraulic Construction Bureau) at Stockholm.—*Reuter's Trade Service* (Stockholm).

American Optimism and British Pessimism.

In its weekly letter dated November 29th, the Federation of British Industries states that in spite of the financial shock which the United States has recently sustained, the news coming from that country is persistently optimistic. There is a determination to cut losses and to undertake a big " prosperity offensive." The F.B.I. contrasts this with our own pessimistic propensities. We bemoan the fact that we are losing ground in export markets, and dolefully point to the large number of unemployed, although we are emerging with a very reasonable show of success from a long and bitter struggle with trade depression. British manufacturers and traders are urged to make more of their successes, for there is a tendency among overseas customers to accept both ourselves and the United States at our own respective valuations.

The Aldershot Company's Hindhead Showroom.

About a year ago the Aldershot Gas, Water and District Lighting Co. took over the Hindhead and District Electric Light Co., and has since been engaged in improving and extending the facilities for the supply of electricity. The opening of a new electricity showroom on November 19th, forms the company's latest development. The ground floor of the building is devoted to the display of lighting fittings and domestic appliances, whilst the premises above are used as

The New Showroom at Hindhead.

a residence by the company's chief accountant. The accompanying illustration shows the attractive arrangement of the interior of the showroom.

Proposed New Electrical Factory.

It is reported that Messrs. ALLEN WEST & Co., LTD., Brighton, are negotiating for the purchase of the Government rolling mills at Woolston, Southampton, which were built at great cost during the war and were completed just prior to the Armistice. The property has a total area of about 82 acres. The company proposes to adapt the mills to the production of heavy electrical equipment, and this side of its business would be transferred to the new works.

Unemployment.

The number of persons on the registers of Employment Exchanges in Great Britain showed an increase of 14,366 during the week ended November 18th. At that date the total was 1,273,500, as compared with 1,259,134 on November 11th, and 1,364,423 on November 19th, 1928.

Japanese Electrical Exports.

Official statistics show that during the first eight months of the current year, Japan exported electric lamps to the value of 3,878,351 yen, as compared with 2,932,062 yen for the whole of 1928. The value of insulated wire exports was 2,399,392 yen (against 1,880,747 yen in 1928); exported electrical machinery was valued at 1,657,016 yen (against 1,104,962 yen); and telephone apparatus at 686,825 yen (against 329,168 yen). The yen is equivalent to about 2s.

North-Western D.J.I.C. Meeting.

The annual conference of authorised undertakers in the North-Western Area, for the purpose of electing employers' representatives on the District Council and District Joint Board, took place on November 26th at the Town Hall, Manchester. The secretary (Mr. A. H. Banks) explained the unavoidable absence of the chairman, Alderman T. E. Higham, this being the first occasion since the creation of the Council (ten years ago) upon which the chairman had been absent. Alderman W. Walker, who presided, dealt with the salient points in the annual reports of the Council and Board during the past year, and the reports were unanimously approved. Three vacancies had arisen in the group of the largest undertakers owing to the retiring representatives having ceased to be members of the councils of the constituent undertakers, and new representatives were appointed by that group. The remainder of the retiring representatives were re-elected. The same members were elected to the District Board with two exceptions.

Australian Tariff Increases.

A number of increases in Australian import duties took effect on November 22nd. Among the classes of goods affected are boilers, wireless receiving sets and headphones.

Turkish Tariff Alterations.

The *Board of Trade Journal* gives a list of alterations in Turkish import duties which will come into operation on April 26th next. It includes dynamos and accumulators, the new rate on which will be 1,900 piastres per 100 kg.; Diesel engines, 300 pts. per 100 kg.; meters and measuring instruments for gas, electricity and water, 3,750 pts. per 100 kg.; and instruments and apparatus for telegraphs and telephones and parts thereof (not including wire), 4,500 pts. per 100 kg.

The Contractors' Dinner.

The annual dinner of the E.C.A. Allied Associations is to be held at the Savoy Hotel on January 22nd, 1930.

Recent Contracts.

THE ALTON BATTERY CO., LTD., has received an order for three batteries for the Shanghai automatic telephone network.

The Auckland Transport Board has placed an order worth £15,000 with the BRITISH GENERAL ELECTRIC COMPANY for 104 "Witton" tramway motors and accessories.—*Reuter* (Wellington, N.Z.).

Messrs. JOHN BROWN & CO., LTD., Sheffield, have received an order for eight hollow-forged steel drums in connection with Puerto Nueva power station and the Cia. Itale-Argentina de Electricidad, Buenos Aires.

New Swedish Cable Factory.

The Allmänna Svenska Elektriska A.B. is establishing a new cable factory in the vicinity of Stockholm, which is to take over the work of the Liljeholm cable works. The latter is said to have been controlled by the A.S.E.A. for some time past.

Swedish Enterprise in South America.

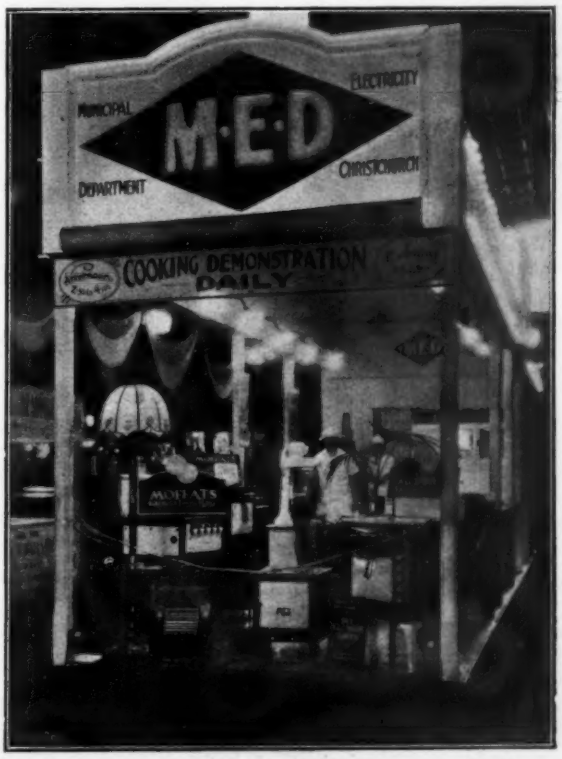
It is stated that the Compania Argentina de Telefonos del Litoral has now become associated with the L.M. Ericsson Company. The seat of the former is in Concordia in the province of Entre Rios, and it owns concessions in the provinces of Corrientes and Missiones, as well as in the Republic of Paraguay.

"Electricity for the Home"—Correction.

Owing to a printer's error, the first line of the third paragraph in the article on Tunbridge Wells ("Electricity for the Home," p. 947), in our last issue, was dropped and another line was put in its place. The correct opening of the paragraph is:—"The rates of charge for energy fall into two scales—one for the town and Southborough, the other for outside areas." A correction was made in the last few thousand copies printed.

A Christchurch (N.Z.) Electrical Exhibit.

We are indebted to the British Electrical Development Association for a photograph (reproduced herewith) of an exhibit arranged by the Christchurch (N.Z.) Municipal Electricity Department at the Christchurch Winter Show held in August last. Mr. E. Hitchcock, general manager of the De-



An Electrical Exhibit at Christchurch (N.Z.).

partment, tells E.D.A. that an attendance of 80,000 was recorded, exclusive of school children, of whom many thousands were admitted free of charge. The Department's stand was a centre of interest, and in addition to practically continuous cooking demonstrations, there were demonstrations of water-heating and other apparatus. A large number of inquiries resulted, many of which have already resulted in sales.

D

Estonian Foreign Electrical Trade.

The *Board of Trade Journal* shows that the imports of "electric machines, apparatus and implements" into Estonia during September, had a value of 320,700 kr. (£17,600), while exports of the same class were valued at 20,400 kr. (£1,100).

The T.S.S. "Orontes."

The twin-screw steamer *Orontes*, which has been constructed on palatial lines, contains many special electric lighting fittings designed and manufactured by Metro-Vick Supplies to the requirements of Mr. A. N. Prentice, architect to the Orient Co.

A Dining Saloon on the T.S.S. "Orontes."

The accompanying illustration shows the luxurious lay-out of one of the dining saloons, which, in addition to concealed ceiling lighting, includes a number of panelled wall-fittings.

New Catalogues and Lists.

METRO-VICK SUPPLIES, Metro-Vick House, 155, Charing Cross Road, W.C.2.—A price list (Folder No. 4102/6) of Cosmos lamps.

CRYSELCO, LTD., Kempston Works, Bedford.—A showcard, illustrating in colour a Christmas tree decorated with Cryselco lamps.

MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A well-produced and illustrated catalogue of the company's radio receivers, loud-speakers and accessories. Priced.

AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Strowger Works, Liverpool.—An illustrated pamphlet drawing attention to Strowger private automatic telephone exchanges.

CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A card drawing attention to Cambridge recording and indicating thermometers.

BROOKHIRST SWITCHGEAR, LTD., Chester.—Leaflet No. 301, referring to the Dutch motor liner *Johan van Oldenbarnevelt*, and particularly to Brookhirst control gear used for the motor-driven auxiliaries.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Publications Nos. 1070/3, 1108, and 1109, dealing, respectively, with the 250-W fixed wave-length telephone set, the 20-50 W portable station, type Y.A.4, and the short-wave transmitter, type T.N.7.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—A current general price list of electrical accessories. [In our last issue we referred to this company's "Xcel" showcard, entitled "Modern Magic," but incorrectly ascribed the publication to Siemens Bros. & Co., Ltd.]

REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton.—Three leaflets containing illustrated particulars of "Revo" loud-speakers, switch and fuse gear, and cast-iron explosion-proof fittings.

Messrs. E. J. WILCOCK, LTD., 30 and 32, Cowper Street, Summer Lane, Birmingham.—A leaflet drawing attention to the company's service for electric motor and dynamo repairs.

BASTIAN METER CO., LTD., Farnham Road, Trading Estate, Slough.—Two pamphlets dealing with "Mascarini" boilers, "Baby Imp" and "Super Imp" fires, "Imperator" radiators and tubular heaters. Illustrated and priced.

Messrs. T. HARDING CHURTON & Co., LTD., Atlas Works, Water Lane, Leeds.—Circular No. 708 giving a description and specification of single-, two, and three-phase induction motors.

Messrs. S. G. BROWN, LTD., Western Avenue, North Acton, W.3.—The November issue of "The Brown Budget" in addition to articles on the company's activities, contains an interesting article on window displays.

ELECTRIC CONSTRUCTION CO., LTD., Bushbury Engineering Works, Wolverhampton.—A well produced and illustrated brochure describing the construction of E.C.C. rotary convertors.

The Industrial Co-partnership Association.

Mr. W. A. Appleton, joint president, presided at the annual meeting of the Industrial Co-partnership Association on November 27th. The report presented drew attention to the steady improvement which had taken place in industrial relations. Mr. F. W. Raffety, hon. treasurer, referred to the scope at the present juncture for a big expansion in the work of the Association, which recognised that a larger measure of publicity and general propaganda must be undertaken at once. He appealed to the general public for largely increased support. It was announced that Mr. Emile Garcke, chairman of the Brush Electrical Engineering Co., Ltd., had become chairman of the executive. The joint presidents—Viscount Cecil and Mr. W. A. Appleton—were unanimously re-elected, as were also the honorary treasurer, Mr. F. W. Raffety, and the joint hon. secretaries, Mr. C. Plaistowe and Mr. F. K. Ogden.

Chesterfield Contractors' Dinner.

Compulsory registration was the principal theme of the speeches at the second annual dinner of the Chesterfield Sub-Branch of the Electrical Contractors' Association held on November 27th. The Mayor, Councillor H. J. Watson, was amongst the guests. Mr. E. R. Morris (chairman), pleading for adequate protection, thought that the only effective way of dealing with the position was for every contractor to be registered in the same way as doctors, lawyers, chemists and dentists were registered. If there was compulsory registration, any installation engineer who was found to have performed "jerry" or unsafe work could be hauled before his registration authority, and be called upon to show cause why his name should not be struck off the register. Mr. T. Beardsall, chairman of the Northern Section, said that the various Government Departments and similar authorities who had to do with electrical installation work were fully alive to the position, and were considering ways and means to amend matters. Mr. L. C. Penwill (General Secretary of the E.C.A.) pointed out the difficulties attending compulsory registration. To his mind it would also involve the compulsory registration of operatives as well as of firms and individual employers. Mr. I. Scott Mackenzie, electrical engineer, Staveley Coal and Iron Co., Ltd., also spoke. The dinner was followed by a dance.

The E.D.A. Outlet Campaign.

An attractive booklet (E.D.A. 800) has been produced by the British Electrical Development Association in connection with the Electric Homes (Outlet) Campaign. It bears the title "The House you Want," and the first half deals very thoroughly with the many things which electricity can "do about the house." Typical appliances are illustrated, and the reader is told what each will do on a consumption of a unit of electricity. The necessity for a sufficiency of plug points is, of course, particularly stressed. The second half goes over the house room by room, from the hall to the garage. Each room is the subject of an illustration, in which the appropriate electrical appliances are shown, and in each picture "outlets" are placed in suitable and convenient positions, being marked by red circles. The booklets are available at £4 per thousand (*i.e.*, less than penny each), with discounts for large quantities. The name and address of an undertaking, company or individual can be placed on the back cover at the printers' net cost. The booklet is certainly worth the price, and should prove of considerable service.

Russian Electrical Imports.

During the fiscal year 1927-1928 the importation of electro-technical products into the Soviet Republic was largely in excess of that of the previous year and was, in fact, easily a record. The large increase is partly explained by the big development in the electrification and the industrialisation of the country and partly by the utilisation of the German credit of 30,000,000 marks. The figures for all electro-technical imports for the two years are as follows:—

	Tons.	Value in roubles.
1926-27	13,971	24,815,000
1927-28	26,465	46,594,000

The average value per ton was thus about 1,770 roubles. This increased importation has taken place at the same time as the local production of electro-technical goods has increased considerably. While the proportion of the imports to the total sales was 23.2 per cent. in 1926-27, it was 29.7 per cent. in

1927-28. As compared with the preceding year, Sweden's share of the business rose from 9.4 to 15.6 per cent., and that of the United States from 5.6 to 8.6 per cent. The first-named country mainly supplied transformers, while the United States supplied mostly precision machinery and sundries. Germany's share of the trade fell from 65.5 to 54.5 per cent., and Great Britain's from 10.1 to 5.7 per cent. In surveying the existing situation, it is clear that, notwithstanding the rapid headway that the electro-technical industry is making in Russia, that country will continue to require increasing quantities of foreign products. It is stated that the Soviet Republic absorbed 16 per cent. of the total exports of this class of goods from all European countries during 1927-1928.

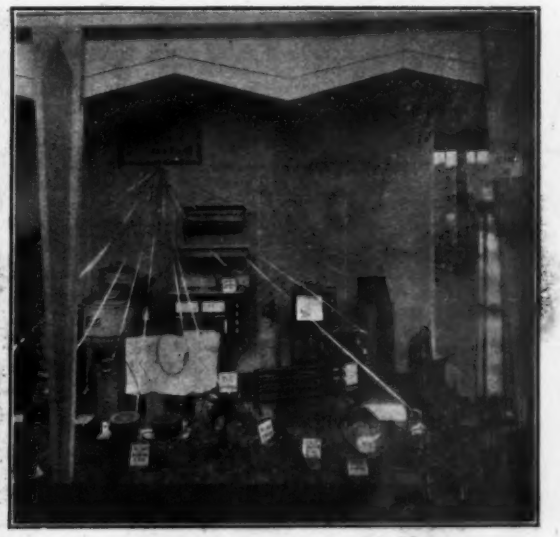
Social Events.

The annual dance of the staff and employés of the Mullard Wireless Service Co., Ltd., was held last Friday at the New Royal Horticultural Hall, Westminster. In spite of the somewhat inclement weather, there was an excellent attendance, some 2,000 of the Mullard staff and their friends being present. During the interval cups and trophies were presented by Mrs. Mullard to winners of various sporting events during the past year. A presentation was made by the staff to Mr. S. R. Mullard during the evening.

The staff of the Andover branch of the Western Electricity Supply Co., Ltd., held a dance at the Guildhall, Andover, on November 29th. Over 200 people attended, and the event was so successful that it is hoped to make it an annual function.

Electricity at the Smoke Abatement Exhibition.

In our review of the recent Smoke Abatement Exhibition at Manchester, we made mention of the electrical stand arranged by a number of neighbouring electricity supply undertakings, with the assistance of the British Electrical Development Association, the Electrical Contractors' Association and a number of leading electrical manufacturers. We have now received from E.D.A. some views of this stand and reproduce two of them herewith. The first imparts an idea of the general aspect of the stand and shows the novel lighting arrangements. The panels flanking the main entrance bear the names of the undertakings responsible for the display. A section of the stand appears in the second illustration. In this compartment a group of typical domestic appliances was arranged. Each appliance was connected by a ribbon to a little poster bearing the words "What a unit of electricity will do," and each was provided with a card stating the number of hours for which a unit of electricity would keep the appliance running. In the centre of the stand was a suite of seven rooms, each equipped with appropriate appliances and wired in accordance with the E.D.A. Specification, while other parts of the stand were devoted to specialised displays of apparatus. Cooking demonstrations (including confectionery and bread making) were given daily.



Two Views of the Electrical Stand at the Manchester Smoke Abatement Exhibition.

Bankruptcy Proceedings.

E. J. G. HUBLES, wireless dealer, 8, Blackfriars Road, S.E., and 119, Cambridge Road, Teddington.—An application for an order of discharge was made on November 29th to Mr. Registrar Mellor at the London Bankruptcy Court, on behalf of this bankrupt who failed in August, 1928. The Official Receiver reported that the provable debts amounted to £1,883 and there were no assets. The bankrupt attributed his insolvency to lack of work and capital, keen competition and price-cutting by traders, to insufficiency of gross profits to meet overhead charges and to bad debts. The application was opposed by the Official Receiver on the following grounds:—Insufficiency of assets to equal 10s. in the £ on the amount of the liabilities; omission to keep proper books of account; trading with knowledge of insolvency; misdemeanour under the Bankruptcy Act; misconduct in that having contracted to purchase for cash goods for sale at minimum prices, the bankrupt had obtained under the pretence of dealing as a trader in accordance with the terms of his contract, and by means of worthless cheques, goods for which he had not paid and had disposed of them at cost price, and otherwise at less than the stated minimum price. Mr. Clifton Hilbery, on behalf of the bankrupt, submitted that the terms upon which his client was re-admitted to the valve manufacturers' "ring" were too onerous, and the bankrupt thought to comply with the terms regarding sales by selling at a ridiculously low rate. He pointed out with regard to a police court charge which had been mentioned, that the bankrupt, acting under advice, pleaded guilty to a technical offence, and when the facts were subsequently before the Court the sentence was remitted to a fine of £15. It was not the desire of the Court to punish a man a second time for an offence, as would be the case if the charge of not keeping proper books were now to be taken into account. He asked the Court to grant a discharge subject to judgment for £25.

The Registrar said the circumstances were not such that he could make a money order, and he suspended the discharge for two years.

L. W. WESTBURY, 383, Birmingham Road, Walsall, Staffs, lately trading as L. W. Westbury & Co. and Walsall Radio Co., 146, Lichfield Street, Walsall, Staffs, wireless goods dealer.—The receiving order in this matter was made on November 1st on the debtor's own petition. The first meeting of creditors was held on November 20th at the Official Receiver's office, 30, Lichfield Street, Wolverhampton, when the case, being a summary one, remained in the hands of the Official Receiver as trustee. The following are creditors:—

	£		£
Cattell, W.	100	Cossor & Co., Ltd. ...	30
Steel, B. A.	100	Green & Jackson ...	23
Siemens Bros. & Co., Ltd.	105	Griffin, J. W., Ltd. ...	57
Brownie Wireless Co. ...	24	Mullard Wireless Service Co., Ltd.	38
Pettigrew & Merriman...	80	Toubkin, J.	82
Ripaults, Ltd.	99	Wilding-Cole, Ltd. ...	67
Burton, C. F., & H. ...	23	Brown, S. G., Ltd. ...	38
Benjamin Electric, Ltd.	26	Turner & Co.	37

H. B. CLARKE, 2, Devonshire Road, Carrington, Nottingham, electrical engineer.—This debtor's application for discharge was heard on November 21st, at the County Court House, Nottingham. The receiving order was made in May of this year, and debtor's statement of affairs showed liabilities of £1,751, against assets that had realised £73. A dividend was to be paid of a little over 3½d. in the £. The discharge was suspended until such time as a dividend of 10s. in the £ was paid.

H. GASCOIGNE, wireless dealer, &c., 40, Cricklade Street, Cirencester, Gloucester.—First meeting, December 3rd, at the Official Receiver's office, 38, Regent Circus, Swindon; public examination December 18th, County Court Buildings, Swindon.

A. K. E. STRATHDEE (Emsco Radio), electrical engineer, 923, Romford Road, Manor Park.—Bankrupt's discharge suspended until January 29th, 1930.

W. T. GARNETT (W. T. Garnett's Cable Co.), electric cable and wire manufacturer, Barkerend Mills, Bradford.—Last day

for proofs for dividend, December 10th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

R. C. Hudson, electrical contractor, &c., 1 and 2, Bridge Road, Chatburn, Lancaster.—Receiving order made November 25th on debtor's own petition. First meeting to-day (Friday) at the Official Receiver's office, District Bank Chambers, Blackburn; public examination, January 15th, at the County Court House, Blackburn.

A. North and F. North (A. & F. North), wireless and electrical engineers, 38, Bradford Road and Market Place, Dewsbury.—Trustee, Mr. F. Gomersall, 16, Bond Street, Dewsbury, released August 12th.

E. E. Peace (Peace & Co.), manufacturing electrical engineer, 230, High Street, Erdington, Birmingham.—First meeting held December 4th, at the Official Receiver's office, 191, Corporation Street, Birmingham; public examination, January 8th, at the Court House, Birmingham.

H. C. Sharpe, wireless engineer, late of 42, Molesworth Street, Wadebridge.—Trustee, Mr. T. Barton, Official Receiver, City Chambers, Catherine Street, Salisbury, released November 15th.

Company Liquidations.

G. Haslam & Co., Ltd., electrical engineers, The Broadway, Leigh-on-Sea.—The statutory meeting of creditors was held recently, when Mr. H. J. B. Feist, the liquidator, reported that the liabilities were £801, of which £501 was due to the trade, and £300 to the bank, and there was a deficiency of £248, so far as the creditors were concerned. The liabilities might be slightly increased, whilst book debts might not produce the figure at which they were set down. The business was established in 1918, and was carried on successfully as a private concern until September, 1922. The company was then formed with a nominal capital of £2,000, of which £1,712 had been issued and was fully paid. During the first year or two the company was successful. A lock-up shop was acquired at London Road, Leigh, but the trade there had not been good, losses aggregating some £700 to £800 having been incurred. It had therefore been closed down, and the stock was removed to the Broadway premises. The creditors decided to confirm the voluntary liquidation of the company with Mr. W. A. J. Osborne (Messrs. Corfield & Cripwell), Balfour House, Finsbury Pavement, E.C., as joint liquidator.

Fellows Manufacturing Co., Ltd.—A petition has been presented to the High Court for the winding up of the abovenamed company by Messrs. Lawrance Messer & Co., 14, Old Jewry Chambers, E.C., creditors, and will be heard in London on December 9th.

Radio Maintenance, Ltd.—A meeting of members is called for December 27th at 15-17, King Street, St. James's, S.W., to hear an account of the winding up from the Liquidator, Mr. J. J. Middleton.

Ideal Wireless Co., Ltd.—A petition for the winding up of this company has been presented to the High Court by A. Rist (1927), Ltd., 133, Moorgate, E.C., and will be heard in London on December 9th.

Dissolutions of Partnership.

Tower Radio Supplies, wireless dealers, 5, High Street, Shoreditch, E.—Mr. M. Davis and Mr. A. Bowman have dissolved partnership. Mr. Bowman will attend to debts.

Barton & Co., wireless dealers, &c., 4, West Crescent, St. Annes-on-Sea.—Mr. C. T. Barton and Mr. L. W. Horner have dissolved partnership.

Book Notices.

"General Physics and its Application to Industry and Everyday Life," by E. S. Ferry. Pp. xix+839; figs. 603. London: Chapman & Hall, Ltd. Price 20s. net.

"Elements of Electrical Engineering," by A. L. Cook. Pp. x+584; figs. 365. London: Chapman & Hall, Ltd. Price 20s. net.

"A Text Book of Illumination," by W. Kunerth. Pp. x+269; figs. 120. London: Chapman & Hall, Ltd. Price 15s. net.

Miscellaneous Publication of the U.S.A. Bureau of Standards. No 95, "Protection of Electrical Circuits and Equipment against Lightning" (25 cents).

"Science Abstracts A and B." Vol. XXXII. Part II. November 25th, 1929. London: E. & F. N. Spon, Ltd. Price 3s. each net.

New Indian Companies.

Among the electricity supply concerns recently formed in India are the Dharwar Electric Supply Co., 64, Shekh Memon Street, Bombay, capital 400,000 rupees; the Upper Jumna Valley Electricity Supply Co., 1,000,000 rupees; and the Upper Ganges Valley Electricity Supply Co., 1,000,000 rupees, the address of the last two companies being 6-7, Clive Street, Calcutta.

Trade Announcements.

The London office of Messrs. A. C. Wells & Co., Ltd., is now at 4, Bradley's Buildings, White Lion Street, Islington, N.1.

Mr. E. Inger, electric light and power engineer, has commenced business at 1, Bank Chambers, Roushill, Shrewsbury. He has a branch concern at 50, Watling Street, Church Stretton.

Messrs. Mosses & Mitchell, Ltd., have taken more commodious premises at Chiswell Works, 60, 62 & 64, Ironmonger Row, E.C.1.

On account of the greatly increasing demand for electric resistance furnaces for industrial purposes, and the wide range of trades for which they are required, the Electric Furnace Co., Ltd., 17, Victoria Street, S.W.1, has formed, and will be the sole proprietor of, a subsidiary company, the Electric Resistance Furnace Co., Ltd., to deal with this branch of its business.

Messrs. M. W. Woods, Ltd., Colchester, inform us that the association of interests between themselves and Messrs. S. G. Leach & Co., Ltd., has been terminated. They have, therefore, again opened an office in London situated at Kingsway Chambers, 46, Kingsway, W.C.2 (telephone: Holborn 4736), in charge of Mr. M. G. Woods.

English Turbo-Generators for Holland.

A large new station is to be built near Ijmuiden for the Provinciaal Electrisch Netbedrijf. After having examined the tenders for the supply of two turbo-generators, a committee of the Provincial States is said to have decided in favour of the acceptance of the lowest offer, which was submitted by Messrs. C. A. Parsons & Co., Ltd., at 1,233,000 fl. This decision has been reached despite the urgent representations of the Minister for Home Affairs and the secretary of the State Commission for Labour Relief that if possible the order should be placed with a Dutch firm. However, the committee came to the conclusion that the question of the reliability of the turbines rendered it desirable for the contract to be allocated to the English company. It appears that an order has also been placed outside Holland for the supply of cables

For Sale.

Nelson Corporation Electricity Department has for sale a number of second-hand d.c. motors, 230 V and 460 V, from ½ h.p. to 20 h.p. (See our advertisement pages to-day.)

Prices of Raw Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, December 3rd: No change in copper prices.

Messrs. James & Shakespeare report, December 3rd: English pig lead, £22 10s., 5s. dec.

Messrs. Edward Till & Co. report, December 3rd: No change in the price of India-rubber, Para fine.

In their letter dated November 30th, Messrs. James Forster and Co. state that after the previous week's declines, the lead market was comparatively steady last week. The market in the United States was also quiet. Consumers' demands in this country remains quiet, their immediate requirements having been satisfied on the drop in values last week. Producers, meanwhile, are maintaining their price without effecting sales of any importance. No revival in demand has been seen from Germany, where trade conditions are reported to be far from satisfactory. Producers may be able to maintain prices for the time being, but in the long run circumstances over which they have no control, may force them to lower their price to a level more in keeping with the position of supply and demand.

Lighting and Power Notes.

Argentina.—Buenos Aires.—A large super-power station has recently been completed in the new port of Buenos Aires by the Compania Hispano-Americano de Electricidad. The buildings and plant, which have taken 34 months to erect and install, cover nearly 17,000 sq. metres, sufficient space being allowed for future extensions producing up to 1,000,000 h.p. The boiler room contains eight boilers and the engine room four turbo-alternators, each of 75,000 h.p. The station is the largest public utility establishment of its kind in Argentina.—*Reuter's Trade Service* (Buenos Aires).

Ashford (Kent).—New Plant.—A new 1,350-h.p. Diesel engine installed at the electricity works was started up recently by Mrs. Wilson, wife of the Urban District Council electrical engineer.

Barking.—Loans Sanctioned.—The Urban District Council Electricity Committee has received sanction to the borrowing of £3,092 for mains, £2,682 for house wiring installations (for hire), and £120 in connection with Becontree sub-station.

Bath.—Revised Electricity Tariff.—The Corporation Electricity Committee recommends the following revised scale of charges for electricity for private residences as from the date of the reading of the meters for the December quarter:—½d. per kWh for any purpose, with standing charge on the ratable value ranging from £2 5s. per annum for up to £14 ratable value to £5 for £40, plus 2s. for every £1 of ratable value over £40.

Birmingham.—Hams Hall Station.—In a report to the City Council, the Electric Supply Committee asks for sanction to a loan of £200,000 to meet the excess expenditure upon the Hams Hall power station.

Electricity Supply Progress.—At a meeting of the Corporation Electricity Supply Committee held last week, states the *Birmingham Post*, the progress report of the department for October was read, showing that 1,026 new consumers' pre-

mises had been connected during the month, adding nearly 9,000 lamps in the lighting section and 2,200 h.p. in the power section. Arrangements were also approved for a number of additional manufacturing supplies, now in hand. It was also reported that the popularity of the domestic contract tariff continued, well over 7,000 consumers having entered into agreements, and that a recent reduction in the charges for connecting up supplies was having the desired effect.

Bognor.—RURAL SUPPLIES.—The first section of the Bognor Gas & Electricity Co.'s scheme for supplying electricity to its rural areas was completed recently, when the e.h.p. main from Middleton sub-station to Yapton sub-station was connected to its supply system.

Bradford.—LOAN.—The Corporation Electricity Committee is to apply for sanction to the borrowing of £200,000 to cover anticipated expenditure for a period of three years.

Burnley.—ELECTRICITY TARIFF CONCESSION.—A concession to Burnley consumers now debarred from participating in the ratable value system of charging for electricity is recommended by the Corporation Electricity Committee. At present these consumers pay 1d. per kWh. It is suggested that there should be an alternative tariff for heating and domestic appliances of 1d. per kWh for the first 360 kWh and ¾d. for each successive kWh.

Canada.—QUEBEC.—The Southern Canada Power Co. is to install power plant in several large branch factories to be erected by British and American companies in eastern Quebec.

MONTREAL.—Consumers of electricity in the City of Montreal and district have now been connected up with an additional source of power derived from a new plant on the Rivière des Prairies (more generally called "The Back River"). The project is unusual in being one of the largest hydro-electric development schemes to be carried out so near to a large city, the power station being not more than seven miles from the financial district of Montreal. The power station will eventually develop 120,000 h.p., for transmission to Montreal, where it will be supplied in bulk to the Montreal Light, Heat, and Power Consolidated for distribution to consumers served by that organisation. The initial installation comprises six units each of 12,000 h.p., only two of which have yet been brought into use, though the other four are likely to be installed before next spring. Power will be stepped up from 12,000 V to 66,000 V, and will be carried by a steel tower transmission line along the south shore into the city of Montreal.

ONTARIO.—In order to satisfy the demand for power in the rural districts, the Ontario Hydro-Electric Power Commission has exceeded its season's programme for the construction of rural transmission lines. The year's programme provides for 1,071 miles, but so far 1,157 miles have been constructed, and work is progressing on 62 miles embraced in the schedule which have yet to be built. A total of 6,700 additional rural consumers will be served by these lines, which will cost approximately £2,650,000.

Continental.—FRANCE.—The Prime Minister last week introduced into Parliament the portion of the National Equipment Bill asking for the immediate vote of £1,600,000 for the development of the electric power industry in France. The scheme aims at making France independent of coal imports by converting more hydraulic power into electricity.

SWEDEN.—The Swedish Vattenfallsstyrelsen (Waterfall Board), which manages the Government-owned hydro-electric stations in Sweden, is asking for a credit of approximately £374,650 in next year's Budget towards the completion of work already started and the enlargement of the Motala and Vasteras power stations. The beginning of constructional work on two new power stations, one at Vargon, to be completed in 1933, and one at Sillre, is also contemplated. In 1928 the Government-owned stations supplied 1,562,000,000 kWh; it is estimated that this year's output will reach 1,700,000,000 kWh.

GERMANY.—Plans have been prepared in respect of a new hydro-electric power station in the Our Valley, near Treves, not far from the Prussian-Luxembourg frontier. The projected installation will have a capacity of 200,000 kW and will necessitate the construction of two large dams.

Coventry.—PLANT EXTENSIONS.—The Corporation Electricity Committee has approved extensions of plant at the Longford generating station, at an estimated cost of £162,000.

MAINS EXTENSIONS.—The Committee is to extend mains at a cost of £4,618.

Crediton.—EXTENSION OF SUPPLY AREA.—The Electricity Committee was instructed at a meeting of the Urban District Council held recently to prepare a report as to the practicability of extending the supply of electricity to Sandford and Newton St. Cyres.

Exeter.—NEW PLANT.—At a meeting of the City Council held last week it was decided that powers be given to the Electricity Committee to apply for sanction to the borrowing of £65,000 for new 7,500-kW plant.

Great Yarmouth.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order made by them authorising the Corporation to supply electricity in part of the rural district of Loddon and Clavering.

Hay.—TRANSFER OF UNDERTAKING.—The Shropshire, Worcestershire, and Staffordshire Electric Power Co. has acquired the electricity undertaking which has been carried on since 1911 by Mr. W. Lilwall. The transfer will take place next March.

Japan.—NEW POWER STATION.—The Nippon Denryoku K.K. is shortly to erect a 35,000-kW power station at Tsurumi to supply electricity to Tokio and the vicinity. The company's 154,000-V transmission line from Ome to Tsurumi is nearing completion, and it has been decided to construct another line from Ome to a place near Tokio, where it is proposed to erect a sub-station of 30,000 or 35,000 kW.

ELECTRICITY SUPPLY PROGRESS.—The Ujigawa Electric Power Co., Ltd., of Osaka, is steadily extending its area of supply. It has now 17 power stations with a total capacity of 111,700 kW in operation and four others aggregating 31,600 kW in course of construction. Government consent to the establishment of nine additional stations, with a combined capacity of 319,180 kW, has been obtained, while application has been made for authority to proceed with the plans for 15 further stations, which will give the company another 36,200 kW.

Kirkham.—INAUGURATION OF SUPPLY.—The Urban District Council's electricity supply scheme was inaugurated on November 28th at Hall Cross, Freckleton, by the Mayor of Preston, Councillor W. Lucas. Coun. E. Hartley (chairman of Kirkham Council) switched on the Kirkham supply, and Mr. R. E. Kent (chairman of Wesham Council) that for the Wesham district. Under the scheme, the supply, which has involved an expenditure of £25,000, is taken from Ribble power station, Preston, to the main sub-station at Hall Cross. There it is reduced from 33,000 V to 6,600 V and transmitted to the distributing centre at Kirkham. There are over 300 consumers.

London.—ST. PANCRAS.—The Borough Council Electricity Committee has obtained sanction to loans of £8,715 for mains and services, £3,831 for meters, £2,214 for consumers' wiring installations (for hire), and £2,580 for domestic apparatus (for hire).

BATTERSEA.—The Borough Council Electricity Committee is to apply for sanction to loans of £78,000 for mains and services, £18,164 for buildings and £3,579 for machinery.

In connection with the South-East England Electricity Scheme the London Power Co., Ltd., has obtained consent to construct a cable tunnel under the River Thames at Battersea to carry cables from the new Battersea power station to the north side of the river.

The Committee has now considered the detailed estimate of the borough surveyor amounting to £29,609, for the erection of the boiler house extension at the generating station, and recommends that the work be carried out.

HAMPSTEAD.—The failure of the electricity supply twice in the course of the last few weeks was the subject of discussion at a meeting of the Borough Council held last week. It was stated that the increased use of electrical energy for lighting, heating, and cooking had caused the existing trunk mains to be considerably overloaded. The nominal capacity of the mains is 13,000 kW, and it is expected that during the Christmas period the load imposed on them will reach 15,000 kW. The Council approved a scheme for providing additional mains at a cost of £47,000.

HORNSEY.—The Corporation Electricity Committee reports that it has received a communication from the London and Home Counties Joint Electricity Authority, offering terms for a permanent arrangement for supplying the Council with electricity. The proposal has been the subject of continuous negotiation with the Joint Electricity Authority since May, and, as it now stands, provides:—(*a*) That the agreement shall continue in force until December 31st, 1950; (*b*) that after the expiration of seven years the Council shall have the option at any time of taking a supply at the "grid price" instead of the price named in the agreement; (*c*) in consideration of an increase in the price already agreed to, the Joint Electricity Authority will repay, in addition to the actual cost of generation at the Council's station, the annual existing loan charges payable by the Council in respect of generation. The committee recommends that this proposal be accepted.

The Electricity Committee is to lay a new feeder to Priory Road sub-station, at a cost of £3,065.

Maidstone.—HOSPITAL SUPPLY.—The Town Council is to give a supply of electricity to the West Kent Hospital on the hospital committee undertaking to pay the capital charges on the actual expenditure for a period of 25 years.

Manchester.—PARLIAMENTARY BILL.—The Corporation has prepared a Parliamentary Bill which seeks powers to enable the Corporation to supply steam for heating and other purposes from any generating station within the city, to repair and maintain consumers' apparatus and fittings and to make by-laws with respect to such apparatus and fittings, and to acquire land compulsorily for the purposes of stations for transforming, converting, or distributing electricity.

LOANS.—The Corporation Electricity Committee is seeking sanction to loans of £50,000 for distributing stations and £100,000 for feeder mains.

New Zealand.—HYDRO-ELECTRIC STATISTICS.—Speaking at the opening of the Power Boards Conference on the subject of hydro-electric developments in the Dominion, the Minister of Public Works stated that the total capital invested in Government developments now amounted to £8,460,505. For the year ended March 31st last the Lake Coleridge scheme showed a total revenue of £186,963 and a working expenditure of £30,131, leaving a gross profit of £156,832. Of this £76,612 was absorbed by interest on loans and £29,847 by depreciation, leav-

ing a net profit of £50,373. The revenue obtained from the Hora Hora scheme amounted to £135,511. Working expenses totalled £76,231, leaving a balance of £59,280 from which had to be paid £53,045 loan interest and £21,527 depreciation. There was thus a net deficiency on the year of £15,291, which was due largely to dislocation of plant during fire and to flooding and silting after the Arapuni diversion. With regard to the Mangahao scheme there was a total revenue, after deducting £72,563 for a bulk supply purchased, of £114,148, a working expenditure of £34,344 and a gross profit of £79,804. After providing for interest on loans £135,358, depreciation £42,714 and insurance £99, there was a net deficit of £98,367 on the year's working.

Northern Ireland.—BANGOR.—The Borough Council has resolved to apply for sanction to a further expenditure of £10,000 for the laying of additional street cables in connection with the distribution scheme.

NEWRY, Co. DOWN.—The Urban District Council has authorised the town clerk to make application for sanction to a loan of £7,500 for a free-wiring scheme and mains extensions.

Plymouth.—ELECTRIC CABLE EXTENSIONS.—At a meeting of the Corporation Electricity Committee held last week, cable extensions were authorised in 21 streets of the city, involving an expenditure of £3,660.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

CARLISLE.—Lighting: From 6½d. to 5½d. per kWh.

LONDON.—*Hornsey.*—Lighting: First 500 kWh, from 4d. to 3½d. per kWh.

Scarborough.—LOAN SANCTIONED.—The Corporation has received sanction to the borrowing of £45,000 for mains, services, and meters.

Stoke-on-Trent.—LOANS.—The Corporation Electricity Committee has obtained sanction to a loan of £3,300 for the erection of sub-stations at Hem Heath and Porthill. The committee is also to apply for sanction to a general loan of £10,000 for services.

Tramway and Railway Notes.

Birmingham.—TRAMWAY EXTENSION.—The Corporation Tramways and Omnibus Committee is to extend the tramway track from Holly Lane to the Dunlop factory.

Bradford.—RAILLESS-CAR SERVICE INAUGURATED.—A railless-car service to Allerton was put into operation on Sunday last.

Continental.—ITALY.—Work has recently been commenced on the electrification of the railway between Voghera and Varzi, a distance of about 20 miles. The power will be supplied from a transformer station at Godiasco.

FRANCE.—Answering a question in the French Parliament recently, the Minister of Public Works stated that during the last four and a half years 51 persons had been killed by contact with live equipment on the electrified sections of French railways, an average of between 11 and 12 persons per year. In the majority of cases the fatalities were due to the imprudence or carelessness of the persons involved, but in view of the fact that the majority of the fatalities had occurred on one railway company's system, a special Departmental Committee had been appointed to inquire into and report upon measures to be adopted to provide greater security.

Croydon.—DOUBLING THE TRACK.—The Town Council has received sanction to a loan of £1,610 for doubling the tramway track near the "Rising Sun" in North End.

Exeter.—THE TRANSPORT QUESTION.—A special meeting of the City Council was held on Tuesday last at the Guildhall, when a report was presented by the Tramways Committee dealing with the visits of a special sub-committee to Birmingham, Wolverhampton, and Hastings to inspect the alternative systems of transport. The Committee recommended that the Council decide to continue the existing tramway services for three years, from April 1st, 1930, before the expiration of which period the Council can again consider the position, and that the Pinhoe Road tramway be at once extended as far as Hamlyn's Lane. A tabulated statement estimated that there would be a net profit of £381, if railless cars were substituted for trams, to give the same service. It had also been proposed that the Devon General Omnibus and Touring Co. should take over the running of 'bus services in the city, at terms to be arranged by the Council. The Tramways Committee did not recommend the Council to entertain the proposal, which, whatever the terms arranged, would give the company a monopoly of transport in the city. The Committee has made arrangements for the renewal of the Fore Street track, at an estimated cost of £1,500, which is to be defrayed out of the revenue.

Glasgow.—RAILWAY ELECTRIFICATION.—Among the clauses in a Provisional Order being promoted by Glasgow Corporation is one proposing that railways in the city shall be operated by electricity or other motive power, the use of which does not involve the emission of smoke.

Japan.—PROPOSED UNDERGROUND RAILWAY.—The Tokio-Yokohama Electric Railway has applied to the Government for a charter to construct an underground railway from Shinagawa, through Hibiya Park to Tokio. It is considered unlikely that the application will be granted, as the proposed line runs parallel with the unopened line of the Tokio Municipal Electric Bureau.

RAILWAY ELECTRIFICATION.—When the electrification of its mills has been completed, the Seitetsusho (Government Steel Works) is to undertake the electrification of its railway at a cost estimated at 5,000,000 yen.

The Government is considering the electrification of its Joyetsu line and plans are being prepared for the construction of the necessary sub-stations.

London.—EXPRESS TRAMCARS.—The Underground Group is considering the conversion of a section of the London United Tramways track between Hanwell and Uxbridge, Middlesex, into a high-speed light railway. Application has been made to the Middlesex County Council for permission to lay a fenced-off track alongside the road.

GOODS TRAFFIC.—In a memorandum issued recently by the London Goods Railway Company further particulars are given concerning the proposed linking-up of the main line railway systems. So far as the goods traffic is concerned, the effect of the scheme, it is stated, will be to make the four main-line railways into one system by linking them together underneath the city. It will be possible to run rapid express goods services for all through traffic, and the hours now occupied in dealing with this class of traffic reduced to minutes. Goods reaching London from the provinces will reach their points of distribution in 35 to 40 minutes instead of the five to ten days now required. It is estimated that the business interests of London will be saved an annual loss of over £60,000,000 due to traffic congestion. The scheme, if carried out, will entail an outlay of £18,000,000 in wages alone.

Maidstone.—RAILLESS CARS.—Application is to be made to the Ministry of Transport by the Corporation for a Provisional Order authorising it to run railless cars along Gabriels Hill and Lower Stone Street.

Manchester.—NEW TRAMWAY POLICY.—At a meeting of the Transport Committee of the City Council, held last week, the general manager of the undertaking suggested, in a report, that:—(*a*) Car mileage should be watched, and extra mileage curtailed at slack times; (*b*) local rate charges should be reduced; and (c) the Department should cease converting cars into the double-bogie vestibule type. Figures presented showed that the cars this year carried 322,815,524 passengers, the revenue being £1,814,705, showing a decline, as compared with last year, of £40,000. The 'bus passengers increased from 14,931,486 to 20,212,221, and the revenue obtained from the 'buses from £133,962 to £225,388. The report was approved by the Committee, and will be considered at the December meeting of the Council.

TRAMWAY LEASE AGREEMENT.—The Transport Committee has ratified its side of an agreement with the Stretford Urban District Council whereby the lease granted to the city to run trams in the Stretford area can be renewed.

St. Helens.—RAILLESS CARS.—The Corporation is to apply to the Ministry of Transport for a Provisional Order authorising it to run railless cars in the urban district of Haydock from the boundary of the borough in West End Road to the present tramway terminus in Church Road.

Wolverhampton.—RAILLESS CARS.—The Corporation is to apply to the Ministry of Transport for a Provisional Order authorising it to run railless cars within the borough and urban districts of Tettenhall and Wednesfield.

Telegraph and Telephone Notes.

Australia.—AUTOMATIC TELEPHONY.—Further progress in the conversion of the telephone system of the Commonwealth from manual to automatic switching is revealed by a statement issued by the Director of Posts and Telegraphs (Mr. H. P. Brown), as is shown in the following table:—

City.	Total telephones.	Automatic telephones.	Conversions, p.c.
Sydney	114,465	87,772	77
Melbourne	92,876	45,662	49
Brisbane	23,971	9,961	42
Adelaide	31,560	15,611	49
Perth	15,851	16,927	69
Hobart	5,106	2,827	78

According to the programme, the networks of the whole of the capital cities should be converted within five years.

Sir William Noble, a director of the British General Electric Co., Ltd., arrived at Hobart on November 25th in connection with the transfer of the Hobart telephone service from the central battery to the automatic system. Sir William visited Hobart as the representative of the B.G.E. Co., which had the

task of installing the equipment, and in an interview he paid high tribute to the general efficiency of the Australian telephone and telegraph services. When he was there two and a half years ago he had been very much surprised to find such developments as there then were in both services. Since then there had been great advances, and he thought that on a population basis Australia was in a leading position.

During the twelve months ended June 30th, 1929, some 29,033 telephones were added to the system, making a total of 505,554. An average of 1.88 connections is made for every cancellation of a service, as against 1.22 in the United States.

POST OFFICE FACTORY.—At Sydenham there will be opened shortly a large workshop for the Postmaster-General's Department, where all postal and telephone repair work will be done. It will cost £35,000, and 280 men will be employed.

France.—TELEPHONY.—The completion of the first 50 years of telephony in France was recently celebrated. The first exchange in the country was set up in Paris in June, 1879, and started with seven subscribers! By 1899 there were nine exchanges in Paris with 6,255 subscribers, and 22 with 4,800 subscribers in provincial towns. About that time the service was taken over by the Government. To-day there are about 150,000 subscribers in Paris and 400,000 in the provinces.

Mexico.—TELEGRAPHY.—The Statistical Department of the national telegraph system has recently issued a report for the year ended July last, which shows that there were then 500 telegraph offices in Mexico, 175 of which were combined telephone and telegraph, and 24 radio-telegraph offices. The number of messages transmitted during the year was 5,734,996, an increase of 140,783 over 1927-28. The Mexican telegraph system comprised 23,547 miles of line with 51,534 miles of wire.

Radio-telephony. — SHIP-SHORE SERVICE. — Wireless telephony which has been installed in the *Leviathan* will be opened to the public on December 8th, when the liner is one day out from New York on her way to Southampton. It is reported that the *Berengaria* and *Majestic* are to be similarly equipped. Officials of the Bell Telephone and American Telephone and Telegraph companies will sail in the *Leviathan* to supervise the first public calls.

TRANSATLANTIC CALLS.—The total number of transatlantic radio-telephone calls during the six months ended October 31st was 7,737. The service is self-supporting so far as Great Britain is concerned.

United States.—COAST-TO-COAST RADIO SERVICE.—On November 15th a transcontinental radio circuit between New York and San Francisco was opened by the Mackay radio stations on the Atlantic and Pacific coasts of the United States. This makes another important step in the establishment of the International Telephone and Telegraph co-ordinated communication services.

Radio Notes.

Aerials.—RENTAL.—Householders who have fixed wireless receiving aerials to trees in Enfield Town Park, Middlesex, north of London, are to pay one shilling per year "rent" to the Town Council.

Austria.—HIGH-FREQUENCY INTERFERENCE.—The police of Klagenfurt, capital of Carinthia, have issued an order forbidding the use of high-frequency massage apparatus, X-ray apparatus, and anything similar which may impede radio broadcasting, between 7 p.m. and midnight, says *World-Radio*, unless urgently necessary for the sick, in which case the doctor making use of such apparatus must take the responsibility of proving the urgency to the satisfaction of the authorities.

Denmark. — LICENCE-FEE REDUCTION. — According to an announcement by the Department of Public Works, listeners' licences taken out during the period from December 15th, 1929, to March 31st, 1930, will be reduced to 5 Kroner (about 5s. 6d.) for the remainder of the financial year.

Germany.—LICENCES.—At the beginning of October last there were 2,843,569 radio receiving licences in operation in Germany, an increase of 16,941, or 0.5 per cent., since July last.

New Zealand.—LICENCES.—There are now 45,938 receiving licences in force, which is a substantial increase on the total at April 30th last, when the figure was 35,880. Station 4YA, Dunedin, has been entirely reconstructed, and was officially opened on October 16th. The operator has full view of the studios through plate-glass windows.

GOVERNMENT REGULATIONS.—The Postmaster-General has announced, says *World-Radio*, that the whole of the New Zealand radio regulations are now in course of revision. When the work is completed copies will be procurable by the general public.

Regional Stations.—LONDON ALTERNATIVE TRANSMISSION.—The *Daily Telegraph* understands definitely that the Brookman's Park second wave transmission will not be regularly used until February 3rd, 1930. Meanwhile listeners will probably hear tests in the course of the next few days, when certain portions of the 2LO programme will be broadcast, first on one wave and then on the other. Later on there will be experiments with both waves with different programmes.

SCOTTISH STATION.—B.B.C. engineers are making tests in the Falkirk area for the proposed new Scottish station in the hilly area midway between Glasgow and Edinburgh.

Sweden.—LICENCES.—On October 1st this year the number of licensed radio sets in use was 416,865, or in the proportion of 68.3 per every 1,000 inhabitants, according to a statement of Director Seth Ljungkvist, head of the Radio Bureau of the Swedish State Telegraph Department. This brings Sweden to the second place amongst the nations, the first place being held by Denmark. As regards the total number of radio listeners, Sweden comes third, with England first and Germany second.

Television.—EXTENSION OF SERVICE.—In view of the increased interest of radio manufacturers and others in the television experimental transmission now being conducted from 2LO by the B.B.C. for the Baird Television Company, an extension of the series has been arranged. Since September 30th transmission has taken place five mornings a week at 11 o'clock, which time proved to be very inconvenient, both to the experimenter and the manufacturing companies which are interested. The series is therefore to be extended, and transmission will also take place shortly on two nights a week after broadcasting hours.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraph Department. January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)*

January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

January 28th. Induction coils and register plates. (B.X. 5899.)*

January 13th. State Electricity Commission of Victoria. 2,200-V switchgear and accessories. (B.X. 5827.)*

Belfast.—December 13th. Education Committee. Installation of electric lighting at North Road P.E. School. Specifications (21s.) from the education architect, Victoria Street, Belfast.

Dundee.—December 11th. Electricity Department. Supply of 3- and 4-core e.h.p. and l.p. cable. Specification from general manager and engineer.

Health Department. Electric lighting installation and additions and alterations at Lilybank Day Nursery. Particulars from the city engineer.

Egypt.—CAIRO.—December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

February 1st. Ministry of the Interior. Centrifugal well pump and direct coupled electric motor with piping and accessories. (A.X. 8811.)*

Halifax.—Town Council. December 21st. Electrician's work in connection with the erection of Girls' High School, Craven Lodge. Specifications, &c., (deposit £2 2s.) from Mr. A. C. Tipple, borough engineer.

Hull.—December 19th. Electricity Department Supply of electricity meters. (November 22nd.)

India.—December 20th. Bombay, Baroda & Central India Railway Co. Supply of glass boxes, plates and wood separators for accumulators. (See this issue.)

Kirkcaldy.—December 18th. Education Authority. Electric and heating work, at additions to St. Agatha's R.C. school, Methil, and Bell-Baxter school, Cupar. Schedules (deposit £1 1s. each) from Mr. E. Sandilands, architect and master of works, Education Offices, Kirkcaldy.

London.—Central Electricity Board. December 21st. Supply, delivery and erection of 132,000-V transformers for the Mid-East England Electricity Scheme, 1929. (November 22nd.)

January 6th. Supply, delivery, and erection of 132-kV overhead transmission lines (special crossings and high spans), for the North-West England and North Wales Electricity Scheme, 1928. (November 29th.)

WANDSWORTH.—December 11th. Union Guardians. Supply of 18 electric sterilisers. (November 29th.)

ISLINGTON.—January 9th. St. Mary Parish Guardians. Supply and erection of five automatic electric lifts at the Infirmary, Highgate Hill, N. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—January 2nd. Alterations to electric lighting installation at the South-Western Fever Hospital, London Road, Stockwell, and installation of car-washing and disinfecting apparatus at Brook, North-Western South-Eastern and South-Western ambulance stations. (See this issue.)

Manchester.—December 13th. Electricity Committee. Electrically-propelled tower-ladder vehicles. (November 29th.)

December 10th. Delivery and placing into position at the Barton power station of 12 single-phase feeder reactors, and the supply and placing into position in the Manchester area of 125, 250, 500, 750, and 1,000 kVA 6,400-400 V 3-phase, oil-immersed, self-cooled transformers. (November 29th.)

December 17th. Supply and erection of one 6,600-V sheet-steel type transformer kiosk and switchgear. (November 29th.)

Millom.—December 20th. Urban District Council. E.h.p. and l.p. cables, pillar box, &c., and e.h.p. and l.p. switchgear, transformer, &c., for the Haverigg extension scheme. (November 22nd.)

Morocco.—December 17th. Post and telegraph authorities of Morocco at Rabat. Supply of 2 tons of copper wire, 2 mm. dia., and 75 tons of high-conductivity copper wire, 2 mm. dia.

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 13th. Four point jacks. (B.X. 5840.)*

January 16th. Telephone switchboard plug covers. (B.X. 5879.)*

Public Works Department. January 14th. Two air compressors and two electric motors. (A.X. 8784.)*

January 28th. Three 50-kW, oil-immersed circuit breakers for Arapuni. (B.X. 5878.)*

South Africa.—PRETORIA.—December 27th. Posts and Telegraph Department. Telegraph material. (A.X. 8734.)*

BLOEMFONTEIN.—January 10th. Electricity Supply Department. Automatic electric traffic signals. (B.X. 5887.)*

JOHANNESBURG.—January 4th. Stores Department. Automatic traffic signals. (B.X. 5924.)*

January 16th. South African Railways and Harbours. Crude oil engine-driven electric generating sets. (B.X. 5926.)*

CAPE TOWN.—January 7th. Electricity Department. Supply of 3-core 11,000-V cable. (B.X. 5925.)*

Tralee (COUNTY KERRY).—Christian Brothers. Electric wiring installation for new schools, Tralee. McEntee and O'Kelly, Consulting Engineers, 23, Upper O'Connell Street, Dublin. (Returnable deposit, £2 2s.)

Wakefield.—December 18th. West Riding Mental Hospital Board. Wiring for electric light, Wadsley Mental Hospital, near Sheffield. Mr. W. E. H. Burton, West Riding Mental Hospitals Board, Wakefield.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—MELBOURNE.—State Electricity Commission.
44,000-V transformers and spares (£2,815); 22,000-V transformers and spares (£5,834).—Weymouths, Ltd.
Lead covered and armoured cable (£1,466).—British Insulated Cables, Ltd.
SYDNEY.—Municipal Council.
Bare copper cable (£18,723).—Wm. Adams & Co., Ltd.
Fibre conduit (£4,731).—Standard Telephones & Cables (Aust.), Ltd.

—Tenders.

Ayr.—
Electrical work at new primary school at Heathfield (£234).—M. & R. Young.

Black Notley.—Essex County Council. Accepted:—
Electricity supply at sanatorium.—Switchboard (£101) Christy Bros. & Co., Ltd.; electric light fittings, F. Thomas & Co., Ltd., and Benjamin Electric Co., Ltd.

Brighton.—Corporation.
Gasfilled lamps.—Edison Swan Electric Co., Ltd.

Cheltenham.—Housing Committee. Accepted:—
Wiring houses at Pilley (£444).—F. H. Bastin and Sons.

Connah's Quay.—Urban District Council. Accepted:—
Main extensions and extensions to sub-station equipment (£1,957).—Crompton Parkinson, Ltd.

Glasgow.—Municipal Transport Committee. Recommended:—
Insulated bolts.—British Insulated Cables, Ltd.
D.c.c. wire.—R. Johnson, Clapham & Morris, Ltd.
Armature coils.—Dyer & Young, Ltd.
Special work (tongues and switches).—Titan Trackwork Co., Ltd., Edgar Allen & Co., Ltd., and Hadfields, Ltd.
Special work (junctions).—Edgar Allen & Co., Ltd.

Grimsby.—Watch Committee. Accepted:—
Automatic light signals.—Forest City Electric Co., Ltd.

Hornsey.—Electricity Committee. Recommended:—
Alterations to switchboard (£855).—A. Reyrolle & Co., Ltd.

Hounslow.—Electricity Committee. Accepted:—
Supply of cable (£606).—Enfield Cable Works, Ltd.

London. — POPLAR. — Electricity Committee. Recommended:—
Blow-down plant, £150.—Filtrators, Ltd.
Pipework.—Millwall Engineering Co., £350.
BARKING.—Electricity Committee. Recommended:—
400 kVA transformer at the works of Messrs. Gross, Sherwood and Heald (£186).—Hackbridge Electric Transformer Co., Ltd.
Four-core cable (£351).—Derby Cables, Ltd.

Newmill.—Urban Council. Accepted:—
Supplying and fixing a cubicle at the Council offices substation to control the 11,000-volt line to Lee Mills (£104).—Yorkshire Electric Power Co.

Scarborough.—Town Council. Accepted:—
E.h.p. and l.p. cables (£18,531).—British Insulated Cables, Ltd.

Stockport.—
Electrical work in connection with the reconstruction of the premises of G. W. Smith & Co. (1925), Ltd.—McClure & Whitfield.

Stoke-on-Trent.—Electricity Committee. Accepted:—
Overhead wiring and services for Etruria Vale housing estate.—Barnett & Soans.
Overhead service lines on Horwills estate, Trentham, £275.—E. Holloway. (In place of previous tender.)

Tynemouth.—Electricity Committee. Accepted:—
Cable (£372).—Macintosh Cable Co., Ltd.

West Ham.—Board of Guardians. Accepted:—
Fire-alarm system at Whipps Cross Hospital (£324).—F. Hodgson.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, December 6th. Institution, Storey's Gate, S.W. 7 p.m. Informal meeting. "Diesel Engine Developments." Mr. W. A. Tookey.

Institution of Electrical Engineers.—Informal meeting. Monday, December 9th. Institution, London, W.C. 7 p.m. Discussion on "To Earth or Not to Earth." Opened by Mr. W. R. Rawlings and Mr. T. C. Gilbert.

Thursday, December 12th. Institution, London, W.C. 6 p.m. Joint meeting with the British section of the Société des Ingenieurs Civils de France. "The Electrical Plant and Network of the Société Electrique de la Sidérurgie Lorraine." Mr. L. A. E. Sekutowicz and Mr. A. Evain.

(Meter and Instrument Section).—Friday, December 6th. Institution, London, W.C. 7 p.m. "Alternating-current Potentiometers and their Applications." Dr. C. V. Drysdale.

(Mersey and North Wales (Liverpool) Centre).—Monday, December 9th. University, Liverpool. 7 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant.

(North-Eastern Centre).—Monday, December 9th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "The Analysis and Measurement of the Noise Emitted by Machinery." Mr. B. A. G. Churcher and Mr. A. J. King.

(North-Midland Centre).—Tuesday, December 10th. Hotel Metropole, Leeds. 7 p.m. "The Heating of Buildings Electrically by Means of Thermal Storage." Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant.

(North-Western Centre).—Tuesday, December 10th. Engineers' Club, Manchester. 7 p.m. Twentieth Kelvin Lecture. "Lightning." Dr. G. C. Simpson, F.R.S.

(Western Centre).—Monday, December 9th. Gloucester. 6 p.m. "The Testing of Porcelain Insulators." Mr. B. L. Goodlet.

(Dundee Sub-Centre).—Thursday, December 12th. University College, Dundee. 7.30 p.m. "Cable Design." Mr. A. F. Stevenson

(South-Midland Students' Section).—Tuesday, December 10th. Coventry. "Routine Testing of d.c. Machinery." Mr. A. H. Slade.

Institute of Wireless Technology.—Monday, December 9th. Engineers' Club, W. 7 p.m. "Reception of Television." Mr. A. W. Thynne.

Illuminating Engineering Society.—Tuesday, December 10th. Home Office, Industrial Museum, Horseferry Road, S.W., 7 p.m. Discussion on Problems in Illuminating Engineering.

Electrical Power Engineers' Association (London Technical Group).—Tuesday, December 10th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Turbo-Alternators." Mr. R. Livingstone.

(Birmingham Local Technical Group).—Tuesday, December 10th. Chamber of Commerce, Birmingham. "Some Aspects of Power Factor Correction." Mr. C. G. Byers and Mr. W. Hanley.

British Electrical Development Association (North-West Area).—Wednesday, December 11th. E.D.A. Demonstration Bureau, 4, Fountain Street, Manchester. 6.30 p.m. "The Value of Exhibitions to the Electrical Industry." Mr. R. C. Hawkins.

Faraday Society and The Electroplaters' and Depositors' Technical Society.—Wednesday, December 11th. Northampton Polytechnic Institute, St. John Street, E.C., 8 p.m. Joint Meeting.

Institution of Railway Signal Engineers.—Wednesday, December 11th. Institution of Electrical Engineers, Victoria Embankment, W.C. 6 p.m. "Some Notes on a.c. Rectifiers." Mr. F. A. Downes.

Institution of Production Engineers (Luton, Bedford, and District Section).—Wednesday, December 11th. Royal Hotel, Luton, 7.30 p.m. Inaugural meeting. "Progress in Manufacturing Methods." Mr. J. H. Garnett.

Institution of Civil Engineers.—Wednesday, December 11th. Institution, Great George Street, S.W. 6 p.m. Informal meeting. "The Heating of Buildings by Electricity off Supply Mains, with special reference to the problem of Heat-storage and Off-peak Loads." Mr. A. H. Barker.

Institute of Fuel.—Wednesday, December 11th. Burlington House, Piccadilly, W. 6 p.m. "The Coal Burning Art as Applied to Steam Production." Mr. W. D. Wylde.

Institution of Engineers-in-Charge.—Wednesday, December 11th. St. Bride's Institute, Bride Lane, E.C. 7.30 p.m. "Pumps and their Selection for Various Duties." Mr. E. B. Tait.

Institute of Metals (London Local Section).—Thursday, December 12th. 83, Pall Mall, S.W. 7.30 p.m. Joint meeting with the Institute of British Foundrymen. "Metal Melting by Electricity." Mr. D. F. Campbell and Mr. W. S. Gifford.

Junior Institution of Engineers.—Friday, December 13th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. Address by the President, Sir Ernest W. Moir, Bart., on "Some Engineering Difficulties and How they were Overcome."

Institution of Engineering Inspection.—Friday, December 13th. Royal Society of Arts, John Street, Adelphi, W.C. 5.30 p.m. "The Trend of Development in Railway Signalling." Capt. B. H. Peter.

Diesel Engine Users' Association.—Friday, December 13th. Caxton Hall, S.W. 3.30 p.m. "A Form of Coupling for Geared Diesel Engines for Land and Marine Purposes." Mr. W. Grose.

Radio Society of Great Britain.—Friday, December 13th. Institution of Electrical Engineers, Savoy Place, W.C.2. 6 p.m. "Tone Compensation and Control for Electrical Gramophones," with demonstration. Dr. N. W. McLachlan.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, December 14th. South Wales Institute of Engineers, Park Place, Cardiff. 6 p.m. "Mining Cables." Mr. W. T. Anderson.

(Western Sub-Branch).—Saturday, December 14th. Swansea. "Electricity in Mines: First Aid." Dr. S. Phillips.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

VENUS mirror arc lamp.
ADAPTABLE type of dry battery for flash lamps, &c.
JUNIT tubular heaters.
RIPOGLASS cables.
PROTEON tubes.

Notes.

The Electrical Engineers' Ball, 1930.

Arrangements have been made for holding the Electrical Engineers' Ball on February 7th next at the Hotel Cecil.

In accordance with our usual custom we print below list of the General and Executive Committees:—

General Committee.

Alabaster, H.
Alabaster, G. H.
Allcock, H.
Atkinson, Ll. B.
Baldwin, O. H.
Balfour, George, M.P.
Bowden, J. H.
Callender, Sir T. O., J.P.
Chattock, R. A.
Cooper, A. R.
Cramb, A. C.
Crawter, F. W.
Cridge, A. J.
Couzens, H. W.
Elder, T. C.
Ferranti, Dr. S. Z. de.
Fox, E. J.
Gatehouse, E. A.
Gill, Frank, O.B.E.
Gillespie, M. M.
Gray, James.
Gregory, J. P.
Gridley, Sir Arnold, K.B.E.
Hadley, A. E., C.B.E.
Hardie, Lt.-Col. C., D.S.O.
Haward, Sir Henry.
Highfield, J. S.
Hill, C. W.
Hirst, Sir Hugo, Bt.
Hunter, P. V., C.B.E.
Hughman, R. W.
Kerr, M. J. D.
Kingsbury, J. E.
Kolle, H. W.
Lackie, W. W., C.B.E.
Leaf, H. M.
Leigh, Lt.-Col. F. A. Cortez.
Lonsdale, W. Stanley.
Macgregor, J. J., C.B.E.
McKinstry, A. E.
McClelland, Wm., C.B.
McMahon, P. V.
Mason, A. V.
Matthews, W. Lee.
Midgley, H. E.
Mordey, W. M.
Moss, E. W.
Nalder, F. H.
Nash, Sir Ph., K.C.M.G., C.B.
New, E. S.
Noble, Sir Wm.
Page, A.
Partridge, G. W.
Pearce, Dr. S. L., C.B.E.
Pooley, F.
Purves, Sir T. F.
Railing, M. J.
Riley, G. E.
Rinder, A. S.
Rogers, F. M.
Rowell, P. F.
Russell, Dr. Alexander.
Sayer, C. E.
Scholey, H., C.B.E.
Siddeley, H. C.
Sillar, A. M.
Sinclair, Dane.
Snell, Sir John, G.B.E.
Sutton, Sir George, Bt.
Taite, C. D.
Taylor, G. M.
Trezise, J. M. G.
Walton, A. H.
Wilson, David.
Woodhouse, W. B.
Worsdell, F. E.

Executive Committee.

O. H. Baldwin.
H. W. Couzens.
A. C. Cramb.
C. W. Hill.
J. E. Kingsbury
W. S. Lonsdale.
P. V. McMahon.
A. M. Sillar.
A. H. Walton.

Hon. Secretaries.

A. M. Sillar. C. W. Hill.

Hon. Treasurer.

J. E. Kingsbury.

Mining Electrical Engineers' "Transactions."

The secretary informs us that he has a stock of Vols. I to XI, 1909 to 1920, of the *Transactions* of the Association of Mining Electrical Engineers, which can be purchased for 5s. per volume, post free, from Mr. Saunders, Regent Buildings, London Road, Derby.

The Radiological Exhibition.

Opened by Mr. A. Greenwood, P.C., M.P., Minister of Health, on December 4th, the exhibition and annual general meeting of the British Institute of Radiology incorporated with the Röntgen Society, lasted for three days. The proceedings, mostly at the Central Hall, Westminster, included the delivery of the tenth Mackenzie Davidson memorial lecture by Prof. Gösta Forssell, whose subject was the radiotherapy of malignant tumors in Sweden. At a meeting of medical members at the Institute, Dr. G. B. Batten opened a discussion on the requirements of clinicians from radiologists and *vice versa*.

On the second day, Prof. S. Russ, Mr. G. Keynes, Dr. M. Donaldson, Dr. J. E. A. Lynham, and Dr. N. S. Finzi took part in a discussion (with opening papers) on aspects of radiation therapy, while Prof. F. L. Hopwood and Miss F. E. Smallman dealt with the use and abuse of radium needles. The twelfth Sylvanus Thompson memorial lecture was delivered by Prof. A. S. Eddington, who entitled it "X-rays in the Stars."

The morning of the third day was devoted to the reading of technical papers, namely: Mr. W. E. Schall, a single-valve plant for diagnosis and deep therapy; Mr. C. Andrews, a mobile X-ray unit; Dr. Ffrangcon Roberts, modern radiological developments in Germany, with special reference to the new Institute at Frankfürt; Dr. A. Orliansky, the output of transformers under different methods of high-voltage rectification; Mr. W. R. Graz, a hot-cathode tube with a rotating anode; and Dr. E. J. H. Roth, the "Mekapion," being ionisation apparatus for the absolute measurment of X-ray dosage.

The afternoon was occupied with papers and demonstrations from the radiological section of the Strangeways Research

Laboratory, namely: Miss S. F. Cox and Dr. F. G. Spear, tissue culture and its application to radiological problems; the action of X-rays on living cells cultivated *in vitro*; and the immediate and delayed effects of radium on tissues cultivated *in vitro*.

The annual dinner was held at the Trocadero Restaurant on the last evening under the presidency of Mr. C. T. Holland. During the meeting the scientific and technical group of the Royal Photographic Society held an exhibition depicting the history and development of the scientific and industrial applications of X-rays, being the first of a series illustrating the uses of photography in the service of man.

The exhibition of apparatus will be dealt with in a later issue.

Overhead Lines Inquiry at Doune.

A Ministry of Transport inquiry was held at Doune, Perthshire, on November 26th, in connection with the proposal of the Grampian Electricity Supply Co., Ltd., to erect overhead lines through the town. Both the local Town Council and the County Council opposed the application. Mr. H. H. Partington, general manager of the company, stated that with overhead works it would cost 30s. to £2 per light, while with underground lines the cost would amount to £3 10s. or £4. The company proposed to erect the poles entirely on the pavements, and there was nothing in the construction of overhead lines that would affect the amenities of the town. Having gone into details as to the cost of construction, Mr. Partington said that the effect of his conclusions was that unless they could erect the installation by the overhead system they could not go on with it at present.

Answering counsel for the company, the Provost said that the Council did not know when it refused the company's application that if overhead works were not allowed Doune would not get an electricity supply. Even had it been known, he did not think it would have altered the Council's decision, because the burgh was adequately supplied by gas. He was, however, a strong believer in electrical development where that was feasible. The decision will be announced later.

The Motor Cycle Exhibition.

One of the features to be noticed at the International Motor Cycle and Pedal Cycle Show (Olympia, London, November 30th to December 7th) is the continued development of electric lighting equipment for solo and combination machines. For instance, the British Thomson-Houston Co.'s equipment is of three kinds: mag-generator, separate generator, or a secondary battery without any generating equipment may be used. The type PA generator is a special permanent-magnet spigot-mounting machine of relatively large diameter and small length, particularly suitable for incorporating with the crank-case or chain-case cover castings. It is designed to run at 1.25 to 1.5 times engine speed, depending on the cycle gear ratio. Type CA 3,000 generator is a 3-in. diameter tubular eccentric machine of the wound-field type which gives 6 volts and operates on the auxiliary brush principle, which limits the charging current at high speeds, and has a maximum current of 6 amperes, the cut-in speed being 900 r.p.m. and the speed at maximum output 2,800 r.p.m. While both the foregoing are designed for special requirements, the mag-generator is of universal application, and can be fitted to almost any motor cycle by mounting it on the magneto platform, in place of an existing magneto, without any modification to the height of the platform being necessary. All B.T.-H. lighting equipment includes a 6-volt battery in a moulded container specially constructed to withstand severe vibration, and a 7-in. headlamp fitted with a four-position switch, an illuminated ammeter registering the generator input to the battery, and separate "bright" and "dim" bulbs. Magnetos occupy a position of prominence and the impulse starter, in conjunction with the magneto, produces an intense spark for starting with quite small applied effort.

The Cardiff Engineering Exhibition.

The annual Engineering Exhibition organised by the South Wales Institute of Engineers was held at the Drill Hall, Cardiff, from November 27th to December 6th. The electrical exhibits included many interesting and new features. Brookhirst Switchgear, Ltd., showed a representative selection of hand-operated and automatic a.c. and d.c. control panels. Messrs. A. Reyrolle & Co., Ltd., exhibited a metal-clad oil-immersed ring main isolator with provision for teeing off a small supply; also the Reyrolle-Holmes automatic traffic control. In addition to their usual lines, Messrs. Ferranti, Ltd., exhibited a 33,000-V lightning and surge absorber. The exhibit of Messrs. Gent & Co., Ltd., included a special signalling arrangement introducing a visible flicker obtained by means of mercury contacts operated by solenoid and a powerful motor-operated alarm bell. Switchgear & Cowans' stand included 11,000-V, 150,000- and 250,000-kVA oil switch units incorporating the Whitehead principle of internal isolation, also 250-kVA, 11,000-V transformers, and a typical pole mounting outdoor transformer by Bruce Peebles. Messrs. Geo. Kent, Ltd., exhibited an electrically-operated indicator for measuring gas pressure and transmitting indications to a distance. The Rapid Magnetting Co. displayed on its stand a 26-in. magnet to lift 7 tons, and its patent shute for separating tramp iron from pulverised fuel. Haslam and Stretton, Ltd., representing various electrical manufacturers, showed a comprehensive range of Eversheds & Vignoles measuring instruments, including the new bridge "MEG" and a model demonstrating a method of testing earth plates. Miners' electric safety lamps were well represented, the principal features on the various stands being: the Ceag Co.: various types of cap and gas-detecting lamps; Oldham and Co.: gas-detecting device; the "Thor" Company: a new type of well glass developed in conjunction with the Holophane Company incorporating its prismatic principle; the Wolf Company: a nickel-cadmium accumulator, the Gulliford gas indicator, and compressed air turbine feeding six 40-W lamps for illuminating coal faces. The stand of Messrs. W. B. Dick & Co., Ltd., was devoted to lubricating oils primarily intended for high-speed reciprocating engines, compressors, turbines, &c., in collieries.

The entrance to the exhibition was effectively illuminated by means of reflector fittings supplied by the Electric Street Lighting Apparatus Co., Ltd.

Official visits were paid to the exhibition on November 30th by the local branches of the Association of Mining Electrical Engineers and the National Association of Colliery Managers. Members of the Western Centre of the Institution of Electrical Engineers are visiting the Exhibition to-day (Friday).

Appointments Vacant.

Plumber-jointer electrician for Brierfield Urban District Council. Switchboard attendant at Kearsley power station for the Lancashire Electric Power Co. Assistant to mains engineer for the Newcastle and District Electric Lighting Co., Ltd. Draughtsman for Manchester Corporation. Full-time assistant master to teach electrical engineering and elementary mathematics at the Hackney Technical Institute. Assistant examiners in Patent Office. Borough electrical engineer and manager for Wolverhampton Corporation. Technical assistant in the testing department of an Admiralty establishment at Portsmouth. Overhead lines engineer for Hull Corporation. (See our advertisement pages to-day.)

National Smoke Abatement Society.

The first issue of the official journal of the National Smoke Abatement Society, *Clean Air*, Autumn, 1929, has just been published. It represents a good start, and contains several interesting articles, including a report of this year's conference of the Society at Buxton. It is to be issued quarterly at the price of 1s., or 2s. 6d. per year, tax free.

The Electrical Association for Women.

Recently, before the South Wales and Monmouthshire branch of the Electrical Association for Women, Mr. T. Batten lectured on "Furnishing Your Home with Light."

The North Wales Branch of the Association celebrated its first birthday with a reception and luncheon at Colwyn Bay on November 30th. Mrs. S. Z. de Ferranti presided, and was supported by Dr. Ferranti, Miss Haslett, Lady Brooks, Mrs. Hyde, Mrs. Price-White, and a representative assembly of over 100 members and their friends.

Institution Notes.

Institution of Electrical Engineers.

South-Midland Dinner.—The annual dinner of the South-Midland Centre of the Institution was held at the Grand Hotel, Birmingham, on November 29th, 1929. The chairman of the Centre, Mr. G. R. J. Parkinson, M.I.E.E., presided over a gathering of some 350 members and guests.

After the loyal toast, the health of the Institution of Electrical Engineers was proposed by the Rt. Hon. Neville Chamberlain, P.C., M.P., who said that his only connection with electricity was that he had once been Postmaster-General. Electricity was an important factor in the commerce by which this country must live. The Act of 1926 was an attempt by the Government then in Office to cheapen electricity, mainly by the pooling of resources and the standardisation of plant. It was not, he believed, popular when it was first introduced, but he believed signs of success were apparent already. He was pleased to notice an awakening to the need for preserving the remaining beauties of our country, but with regard to the pylons on the South Downs and the threat to the purity of London by the proposed power station at Battersea, they need have no fear from the work of Sir Andrew Duncan and his colleagues. The Institution was the centre for the co-ordination and distribution of technical knowledge, and was recognised as such by the Government. He was glad to note the prosperity of the constructional side of electrical engineering, which he attributed to the fact that experience gained in the home market had enabled manufacturers to compete effectively in foreign markets. Col. Sir Thos. Purves (president, I.E.E.), responding, said that the Institution, like the British Empire, had had its problems due to its evolution as an organism, and had found it necessary, with the help of the local Centres, to place its constitution upon both a functional and territorial basis. The Institution might be termed an imperial democracy. Presidents of the Institution had generally no opportunity of gaining any knowledge of the Centres; until they had assumed office and visited them. He was glad to see the awakening public conscience in regard to pylons; it diverted attention from the little telegraph and telephone lines running overhead throughout the country.

Mr. G. R. J. Parkinson then proposed the toast of "Kindred Associations and the Guests." He referred, among others, to the distinguished services of the Rt. Hon. Neville Chamberlain, which men of all parties would acknowledge, and the importance of sound Press publicity. He took the occasion to congratulate Mr. Forrest on his forthcoming succession to the position of chief engineer at Birmingham. He would not wish Mr. Chattock happiness in his well-earned rest, as rest would not be possible to Mr. Chattock.

Sir Andrew Duncan, in a brief reply, said that Birmingham had provided opponents of the legislation of 1926, but now that the Act was in operation their erstwhile opponents could be relied on to co-operate for its success. He looked forward to a great expansion of railway electrification.

Mr. S. H. Holden proposed the health of the chairman, and the dinner terminated in a re-union.

The local branch of the Electrical Contractors' Association held a dance on the same evening in aid of the Electrical Trades Benevolent Institution, and some of those present at the dinner took the occasion to support this worthy cause.

MERSEY CENTRE DINNER.—There was a record attendance at the annual dinner of the Mersey and North Wales (Liverpool) Centre of the Institution at Liverpool on November 27th. All the speeches sounded an optimistic note, and whilst there was a tendency to be retrospective, it was admitted that the activities of the Electricity Commissioners and the Central Electricity Board were bound to be advantageous. Prof. E. W. Marchant, D.Sc., M.I.E.E., presided. Dr. H. J. W. Hetherington, M.A., vice-chancellor of Liverpool University, in proposing "The Institution of Electrical Engineers," said that professional service tended to improve in quality as the Institution became conscious of its corporate responsibility to the community it served.

Col. Sir T. F. Purves, O.B.E., M.I.E.E., president of the Institution, remarked in a humorous speech that the proposed trans-atlantic telephone cable, which people would be able to use for about £3 per minute, would have one great virtue—it would cure his countrymen of the bad habit of stuttering. As every stutter would cost 6d., there would be every incentive to faultless speech. The relationship between the Institution and its various Centres was extraordinarily happy. It recognised its responsibilities and, therefore, could not distribute its favours loosely or promiscuously. From the local Centres had emanated many of the ideas that had made the constitution of the Institution so successful and flexible, and had enabled them to combine freedom with centralised allegiance to the whole.

The Lord Mayor of Liverpool (Councillor Lawrence Holt, J.P.), proposed "The Electrical and Allied Industries," the technical excellence of which was one of the proud boasts of this country. He hoped that the position would always be maintained, but uttered a word of caution:—"Let us dig deeper foundations and make sure that we shall possess an electrical edifice that will survive for all times. Short cuts to immediate prosperity are dangerous."

Lord Cozens-Hardy, D.L., said that, in spite of its adoption by political parties as a panacea for all ills, electricity had entered completely into the daily lives of every individual and continued to spread with amazing regularity. One hoped progress would not be impeded by the novel and interesting departure in national organisation for which the Electricity Commissioners were responsible. In some ways they seemed to be a kind of legalised version of the bureaucratic usurpations against which Lord Hewart had so ably protested, yet one must recognise that some sort of co-ordination (that blessed word!) was necessary if electrical development was not to be impeded.

That there should be so little unemployment in electrical engineering was not entirely attributable to the special abilities of those engaged in the trade, but they could at least claim that they had made good use of the vast opportunities which the scientific discoveries of the last 50 years have brought within their reach.

Mr. V. Watlington, M.I.E.E., said that the industry was based primarily on the foundations laid in the technical colleges and universities. The industry required fresh brains which must come from the bottom and pass to the top, for an industry that did not grow from the bottom became stagnant. Research in such a highly technical industry as electrical engineering was of immense value, yet it was difficult to get people to take up research work, because the rewards were not the same as those which could be obtained in the commercial sphere. Without research the commerce attached to the electrical industry could not flourish. Much use had been made of the word "rationalisation," of which everybody was a little tired. In the electrical industry it meant striving to have a certain number of works employed to capacity, instead of a larger number working at only 60 per cent.

The health of "Our Guests" was proposed by Mr. P. J. Robinson, Liverpool city electrical engineer, and responded to by Prof. L. R. Wilberforce, M.A., in a witty speech.

Mr. A. E. Malpas, who deputised for Mr. S. E. Britton, Chester, submitted a toast in honour of the chairman, Prof. E. W. Marchant, D.Sc., M.I.E.E., who said it was the business of universities to train men in technical knowledge and fundamental principles. If the universities taught only technical things their students would be out-of-date before they went into practice. Prof. Marchant paid generous tribute to Mr. O. S. Waygood, hon. secretary of the Centre.

INFORMAL MEETING.—At the informal meeting of the Institution held on November 25th, Mr. R. Grierson being in the chair, when Mr. C. Wade opened a discussion on "Wooden Poles for Transmission Lines and their Preservation." His remarks were mainly concerned with the treatment of poles by creosote, and he exhibited a number of slides and specimens of woods illustrative of practice. Many G.P.O. telegraph creosoted poles had been standing for 50 years or more. Mr. Wade showed a view of a travelling plant for heating and creosoting poles on site in Sweden, where suitable trees abounded and where apparently it was less easy to transport the timber. Various trees that have been applied to the use of overhead lines were considered: larch or spruce could not be satisfactorily substituted for red pine. On the question of helping employment by substituting ferro-concrete or steel poles for wood, it was stated that, though steel and concrete were British products, the extra labour on timber, together with carriage by British ships from overseas, might provide as much employment.

Mr. G. V. Twiss did not think anyone could dispute the claims Mr. Wade made for wodden poles. He thought it uneconomic to use wood for 132,000-V lines, mainly on account of length, but he knew of poles on 66,000-V lines, and he believed in the U.S.A. they had been used for 100,000-V, Regarding maintenance, he knew of a number of steel masts which have been in service for 30 years without any appreciable trouble.

Mr R. H. Herford said that in many cases the creosote drained from the pole into the surrounding earth, and so probably served to maintain the timber. The serious shortage of Scotch fir (*Pinus Sylvestris*) which is undoubtedly the most suitable for poles, had compelled experiments on larch and spruce, and a new treatment showed great probability of overcoming the resistance to penetration by those trees.

Messrs. S. C. Bartholomew, R. G. Bennett, R. Grigg, A. F. Harmer, N. Prentice and E. S. Ritter also spoke.

WEST WALES (SWANSEA) SUB-CENTRE.—On November 29th, under the chairmanship of Mr. J. W. Burr (electrical engineer and manager to the Swansea Corporation), Mr. R. Borlase Matthews repeated the paper he recently presented in London dealing with the 1929 summer visit of the I.E.E. to France. It was illustrated with kinematograph films taken by Mr. Bertram Thomas and the author, also by lantern slides made by Mr. F. Hope-Jones (London) and by Mr. C. Wilson (Birmingham). Interest was added to the proceedings by the fact that several Swansea members had taken part in the visit. Some films were also shown of previous I.E.E. visits to Newcastle and Scotland. The discussion chiefly turned upon the wonderful load factor of nearly 95 per cent. that is obtained in the Pyrenees plant, and how it was obtained.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. P. J. PYBUS has been appointed a joint-deputy chairman of the Phœnix Assurance Company.

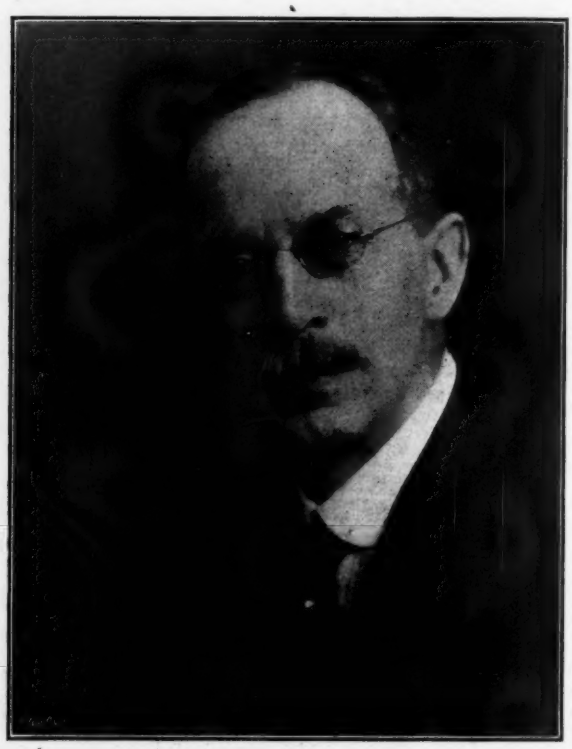
Mr. H. A. MACRAE, M.B.E., Assistant Japanese Secretary at the Tokio Embassy, has been appointed Commercial Secretary at Tokio, in the place of Mr. R. Boulter, C.M.G., who was recently appointed Trade Commissioner at Singapore. Mr. Macrae has had considerable experience of the duties of his new post.

Standard Telephones and Cables, Ltd. announce the following changes in staff:—Mr. H. C. TRENAM resigns his position as Deputy Manager in order to accept the appointment of Assistant European General Sales Manager of the International Standard Electric Corporation. Mr. F. J. E. BRAKE relinquishes his position of Sales Manager to become Technical Director of Standard Telephones and Cables, Ltd. Mr. J. W. KEEFE is appointed Sales Manager of Standard Telephones and Cables, Ltd. Mr. H. A. P. DISNEY resigns his position as Secretary to Standard Telephones and Cables, Ltd., in order to take up special duties with the International Standard Electric Corporation. Mr. H. G. PATERSON has been

appointed to the position of Secretary of Standard Telephones and Cables, Ltd.

In our last issue we mentioned the pending retirement of Mr. R. A. CHATTOCK from the post of city electrical engineer, Birmingham. At its last meeting the Birmingham Electric Supply Committee placed on record its "appreciation of Mr. Chattock's eminent services in the building up of the highly successful electrical undertaking which the city now possesses." After giving careful consideration to the question of appointing a successor, the Committee decided to recommend the appointment of Mr. FRANK FORREST, M.I.E.E., M.I.Mech.E., as city electrical engineer from the date of Mr. Chattock's retirement, January 25th next. The salary proposed is £1,800 per annum.

Mr. E. J. JENNINGS, F.C.I.S., Assoc. I.E.E., who has been secretary to the Department for the past twelve years, is



Elliott & Fry [*London.*

Mr. E. J. Jennings, F.C.I.S., Assoc. I.E.E.

Secretary and Commercial Manager of the Birmingham Electric Supply Department.

responsible to the Committee for the commercial management of the undertaking, and the Committee considers Mr. Chattock's impending retirement a fitting opportunity, which it has taken, of altering the title of Mr. Jennings's office to that of secretary and commercial manager. The city electrical engineer will continue to be responsible for the whole of the engineering side of the Department, both generation and distribution. As our readers are aware, Mr. Jennings is hon. secretary of the Electrical Section of the British Industries Fair, Birmingham.

A well-attended gathering of members of the staff of the Yorkshire Electric Power Co. assembled at Leeds last week for the joint purpose of bidding farewell to a Mr. R. H. HARRALL and felicitating Mr. OLDROYD and Miss CROWTHER on the occasion of their marriage. Mr. Harrall, who has been a mains engineer on the staff of the company for 11 years, is leaving to take up an appointment as mains superintendent in the Blackburn Corporation Electricity Department. He was presented with a clock, a loud-speaker, and an illuminated address. Mr. Oldroyd and Miss Crowther have served on the company's staff for 17 and 14 years, respectively. They were presented with a pewter tea-service, a canteen of cutlery, a case of fish-eaters and an illuminated address. Speeches were made by Mr. W. B. Woodhouse (engineer and manager), Mr. J. J. H. Stansfield (secretary), Mr. H. C. Fraser (superintendent of organisation) and Mr. S. R. Siviour (chief mains engineer). The evening concluded with music and dancing.

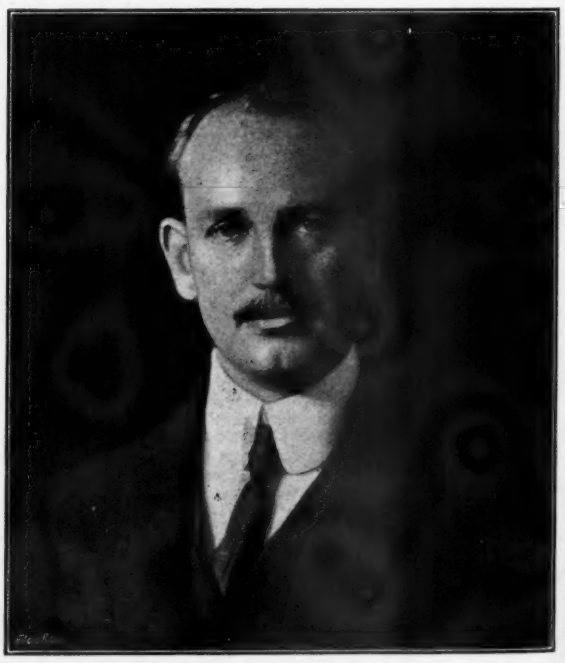
The Hewittic Electric Co., Ltd., states that Mr. A. MANIGHETTI, A.M.I.E.E., is leaving the company to take up a position with the Sterling Varnish Co. Mr. Manighetti has been with the Hewittic Co. for fourteen years.

Mr. P. SARVENT, of the Hammersmith Electricity Department, has been appointed by the Leeds Corporation Electricity Committee as resident engineer to be in charge of the new super-power station at Kirkstall, now in course of construction. The appointment, subject to confirmation by the City Council, carries a basic salary of £750 per annum. Mr. Sarvent will take up his new duties in February.

Mr. H. F. FIELDS, of the Leatherhead & District Electricity Co., Ltd., has been appointed station superintendent at the Horsham electricity works at a salary of £300 per annum.

Subject to confirmation by the Town Council, the Derby Tramways Committee has confirmed the appointment of Mr. P. W. BANCROFT as manager of the Corporation tramways. Mr. Bancroft has been in the Corporation's service for about 29 years.

We reported in our issue of October 4th that Dr. F. E. SMITH, C.B., C.B.E., F.R.S., had been appointed Secretary to the Committee of the Privy Council for Scientific and Industrial Research. On Saturday last he was elected Secretary of the Royal Society in succession to Sir J. H. Jeans. Dr. Smith entered the Royal College of Science as a National Scholar in 1895, and was the Senior Associate in Physics in 1898. He remained as demonstrator in physics until 1900, when he joined the National Physical Laboratory. There he formed one of a small company of pioneers who, under the directorship of Sir Richard Glazebrook, laid the scientific foundation of that institution. His earliest work was connected with electrical standards, the precision of comparison of which and their absolute determination he raised to a very high degree of accuracy. He developed many forms of the Wheatstone and Kelvin bridges for precise measurements of resistance and for accurate work with platinum resistance thermometers, and these are now in general use. A classical piece of work was conducted by him in co-operation with Professors Ayrton and Mather on the absolute measurement of current, the probable error of measurement in C.G.S. units being not greater than one in fifty-thousand. Subsequently, he developed a silver voltameter which bears his name, and which is universally accepted as the most reliable form, in that there is no septum or envelope between the anode and cathode. Another successful development was the Weston cadmium cell with a slightly acid solution. A second classical piece of work was the absolute measurement of resistance by a modified form of Lorenz apparatus designed by Dr. Smith and installed at the National Physical Laboratory. This, and other work of a similar nature, led Dr. Smith to become a foremost advocate of the absolute system of measurement and the abolition of electrical standards based on other systems, though closely related to the C.G.S. system. He has also developed various magnetometers for the absolute measurement of magnetic intensity. One of these instruments now forms the standard for the measurement of horizontal intensity at the Magnetic Observatory at Abinger, and a second is in use by the Ordnance Survey. In 1920 Dr. Smith left the National Physical Laboratory to assume the position of Director of Scientific



Swaine [*London.*

Dr. F. E. Smith, C.B., C.B.E., F.R.S.

The new Secretary of the Royal Society.

Research at the Admiralty. There he organised the Scientific Research and Experimental Department, and became responsible for the general conduct of the many phases of naval research. He was president of the Physical Society in 1923-24, and served as one of the hon. secretaries of the British Association from 1922 until last month, when he resigned on being elected Secretary of the Royal Society.

The Maidstone Town Council has decided to grant a gratuity of £1,050 to the borough electrical engineer, Mr. E. E. HOADLEY, for special services rendered. It is stated that the sum was agreed upon when Mr. Hoadley was about to accept another appointment. When this decision was arrived at on November 27th, the chairman of the Electricity Committee mentioned that had the Council obtained other expert advice it would have cost at least £6,000.

At a recent meeting of the Council of the Electrical Contractors' Association, Mr. W. H. WALTON, immediate past-president, was elected a fellow of the Association. Mr. Hawkins, on behalf of the London branch, has presented a portrait of Mr. Walton to the Association.

Mr. H. MOZLEY, manager of the Burnley Transport Department, is retiring on March 31st next, after 29 years' service. He is to receive an illuminated address recording appreciation of his long and faithful service. Mr. Mozley was manager of the company from which the Corporation acquired the tramway service. The Council has decided to advertise for a successor at a salary of £550 per annum, rising by two increments of £25, to £600.

At Sheffield Corporation Tramways Committee, the general manager reported the resignation of Mr. R. C. MOORE, traffic assistant, he having been appointed traffic superintendent of the Stockton-on-Tees omnibus undertaking.

Mr. W. A. ROBINSON, A.M.I.E.E., has been appointed mains superintendent in the City of Winchester Electricity Department. We understand that an extensive rural electrification scheme is being proceeded with in this undertaking's area.

On December 2nd, at the Electricity Office, Loughborough, the borough electrical engineer, Mr. G. J. HOLLYER, was presented with fountain pens and a pen stand by the employés of the undertaking. Mr. Statter expressed appreciation of the cordial relations which had existed between Mr. Hollyer and the staff during his stay in Loughborough; he also extended to the new engineer, Mr. Fowles, a hearty welcome to Loughborough. Alderman Stenson, chairman of the Electricity Committee, made the presentation, and wished Mr. Hollyer success in his new appointment as engineer and manager of the Torquay undertaking.

Obituary.—Mr. W. CLAYTON.—The death has occurred, at the age of 40 years, of Mr. William Clayton, a partner in the firm of Messrs. Clayton & Rogers, electrical contractors, Plymouth. Several representatives of the electrical industry were present at the funeral service, and the floral tributes included wreaths from the Electrical Contractors' Association, the employés of Messrs. Clayton & Rogers, and from a number of electrical contracting firms.

Mr. W. R. BOWER.—The death occurred on November 20th of Mr. William Richard Bower, who was for over 30 years head of the Physics and Electrical Engineering Department of the Huddersfield Technical College. He retired from this position at the end of 1926.

Mrs. F. M. FLETCHER.—We regret to record that the wife of Mr. F. M. Fletcher, A.M.I.E.E., borough electrical engineer to the Darwen Corporation, passed away in a Blackburn nursing home, following an operation, on Saturday last.

Mr. A. E. SLATER.—Mr. A. E. Slater, partner in the electrical business of Bassano & Slater, and later proprietor of Slater & Oakes, both of Derby, met his death recently at the age of 74 years as the result of a motor accident.

Mr. C. A. BLASCHECK.—We regret to record the death, which occurred on November 26th, of Mr. Charles Albert Blascheck, M.I.E.E., city electrical engineer of Canterbury. He was 55 years of age, and in 1902 he succeeded Mr. Norman Staniland as city electrical engineer. He came to Canterbury from Norwich, where he had been chief assistant electrical engineer. Prior to that he was with the St. James's & Pall Mall Co.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Hyperlite Units, Ltd.—Private company. Registered November 29th. Capital, £100 in £1 shares. Objects:—To carry on the business of manufacturers of "Hyperlite" units, electrical signs and apparatus, &c. The subscribers (each with one share) are:—A. T. Dawles, 12, Gloucester Road, Romford, Essex, clerk; C. P. Brightwell, 3-4, Lincoln's Inn Fields, W.C., clerk. The first directors are not named. Registered office: 25, Islington Green, N.1.

Radium Electric, Ltd.—Private company. Registered November 25th. Capital, £5,000 in £1 shares. Objects: To adopt an agreement with Erko Radium Kompresse, M. Munzer, and to carry on the business of manufacturers of and dealers in electrical and radio-active apparatus of all kinds, including an electrically-heated compress pad or bandage adapted for medical, surgical or curative purposes, &c. The directors are: C. P. Lister, Combe House, Dursley, Gloucester; R. B. Lister, "The Elms," Stone, Gloucester (directors of R. A. Lister and Co., Ltd.); R. P. Forster, 65, Blenheim Terrace, N.W.8. Registered office: 24, Grosvenor Gardens, S.W.1.

R. J. Robinson & Co., Ltd.—Private company. Registered November 23rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of engineers, founders, smiths and machinists, electricians, electrical engineers, &c. The provisional directors are: B. G. Stone, Myrtle House, Brackenboro Road, Louth, estate agent; R. J. Robinson, Inglenook, Brackenboro Road, Louth, electrical engineer. Solicitors: Falkner, Son & Roberts, Louth, Lincs.

Bell Radio Co., Ltd.—Private company. Registered in Edinburgh on November 23rd. Capital, £3,000 in £1 shares. Objects: To acquire the business of the Bell Radio Co., wireless specialists, 33, George Street, Edinburgh. The directors are: J. Ferguson, 64, Merchiston Avenue, Edinburgh, paint merchant; L. Bell, 16, Barnton Gardens, Davidson Mains, Edinburgh, engineer; W. Sime, 22, Panmure Place, Edinburgh. Qualification: 100 shares. Registered office: 8, Frederick Street, Edinburgh.

Rigby & Partners, Ltd.—Private company. Registered November 26th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, dealers in and erectors of electrical plant, equipment, apparatus and accessories, &c. The subscribers (each with one share) are: Eleanor M. Herbert, 140, Belgrave Road, Edgbaston, Birmingham, typist; F. E. Francis, 10, High Street, Smethwick, Staffs, law clerk. The first directors are to be appointed by the subscribers. Secretary: F. E. Francis. Registered office: 53, Victoria Street, Westminster, S.W.1.

Ramsbottom Electrical Heating & Lighting Co., Ltd.—Private company. Registered November 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, electrical engineers and contractors, mechanical and general engineers, cabinet makers, workers and dealers in electricity, gramophones, wireless sets, &c. The directors are: F. Haworth, Bergvik, 170, Peel Brow, Ramsbottom; E. Holden, 25, Bridge Street, Ramsbottom. Registered office: 25, Bridge Street, Ramsbottom.

British Telehor, Ltd.—Private company. Registered November 21st. Capital, £100 in £1 shares. Objects:—To manufacture or deal in any equipment used in connection with transmitting or receiving, producing, recording or reproducing by electrical or any other means any matter, whether consisting of sounds, images, signals, impulses, or otherwise, &c. The subscribers (each with one share) are:—A. Fletcher, 31, Princes Court, Wembley, solicitor; A. E. Spencer, "Forest Dene," Oakhill Crescent, Woodford Green, clerk. The first directors are to be appointed by the subscribers. Solicitors: Herbert Oppenheimer, Nathan & Vandyk, 1, Finsbury Square, E.C.2.

Official Returns of Electrical Companies.

Pinnacle Investment Trust, Ltd.—E. L. Donald, Atlantic House, 46, Holborn Viaduct, E.C.1, was appointed receiver and manager on November 13th, under powers contained in debenture dated August 1st, 1929.

"M.P.A." Wireless, Ltd.—Issue on November 1st of £500 and on November 7th, 1929, of £600 debentures, parts of a series already registered

New System Private Telephones, Ltd.—Capital, £20,000 in £1 shares. Return dated July 22nd, 1929. 15,000 shares taken up. £13,000 paid. £2,000 considered as paid. Mortgages and charges, nil.

Burndept Wireless (1928), Ltd.—Capital, £200,000 in 5s. shares. Return dated September 27th, 1929. 620,021 shares taken up. £102,504 0s. 6d. paid (being 5s. per share on 20,007 shares and 3s. 3d. per share on 600,014 shares). £52,501 4s. 6d. considered as paid (being 1s. 9d. per share on 600,014 shares). Mortgages and charges, nil.

General Electric Co., Ltd.—Capital, £7,600,000 in 1,800,000 6½ per cent. "A" preference, 1,800,000 7½ per cent. "B" preference, 2,400,000 ordinary and 1,600,000 British ordinary shares of £1 each. Return dated July 18th, 1929. 1,800,000 "A" preference, 1,800,000 "B" preference and 2,253,645 ordinary shares taken up. £4,831,819 paid on 1,575,540 "A" preference, 1,777,109 "B" preference and 1,479,170 ordinary shares. £1,021,826 considered as paid on 224,460 "A" preference, 22,891 "B" preference and 774,475 ordinary shares. Mortgages and charges: £3,068,060.

Tetbury Electric Supply Co., Ltd.—Capital, £6,000 in 600 cumulative preference shares of £5 each and 3,000 ordinary shares of £1 each. Return dated July 3rd, 1929. 300 preference and 2,107 ordinary shares taken up. £3,607 paid. Mortgages and charges, nil.

British Electric Traction Co., Ltd.—Capital, £2,998,397 15s. in £712,744 5s. 6 per cent. cumulative participating preference stock, £1,326,263 10s. 8 per cent. non-cumulative preferred ordinary stock and £167,676 deferred ordinary stock and 287,256 6 per cent. cumulative participating preference shares and 504,458 ordinary shares of £1 each. Return dated July 1st, 1929. All the preference and preferred ordinary stock and £147,888 deferred stock issued and fully paid up. Mortgages and charges: £1,665,331 18s. 9d.

I.T.C., Ltd.—Capital, £20,000 in £1 shares. Return dated July 22nd 1929. 15,000 shares taken up. £15,000 paid. Mortgages and charges, nil.

Teignmouth Electric Lighting Co., Ltd.—Capital, £50,000 in 20,000 7 per cent. cumulative preference and 30,000 ordinary shares of £1 each. Return dated June 6th, 1929. All shares taken up. £49,500 paid. £500 considered as paid. Mortgages and charges: £12,500.

Radioco, Ltd.—Capital, £2,500 in £1 shares. Return dated September 26th, 1929. 2,200 shares taken up. £2,200 paid. Mortgages and charges, nil.

Wark and District Electric Lighting Co., Ltd.—Capital, £1,500 in £1 shares. Return dated June 4th, 1929. 1,500 shares taken up. £1,500 paid. Mortgages and charges, nil.

Reproduction, Ltd.—O. F. Falk, 19, Ironmonger Lane, E.C., was appointed receiver and manager by Order of Court dated November 15th, 1929.

Midland Rubber Co. (1913), Ltd. (formerly Midland Rubber Goods Manufacturing Co., Ltd.).—C. H. Smith, Phœnix Chambers, Colmore Row, Birmingham, was appointed receiver on November 20th, 1929, under powers contained in first mortgage debenture dated November 15th, 1923.

West African Telegraph Co., Ltd.—Capital, £400,000 in £10 shares. Return dated September 11th, 1929. 23,109 shares taken up. £231,090 paid. Mortgages and charges, nil.

Anglo-Argentine Tramways Co., Ltd.—Capital, £11,000,000 in 800,000 first preference and 710,000 second preference shares of £5 each and 862,500 ordinary shares of £4 each. Return dated July 9th, 1929. 640,000 first preference, 610,000 second preference and 675,000 ordinary shares taken up. £850,000 paid. £8,100,000 considered as paid. Mortgages and charges: £70,660 annuity; £4,465,674 4 per cent. debentures; £1,733,380 4½ per cent. debentures; and £6,000,000 5 per cent. debentures.

Electric & General Investment Co., Ltd.—Capital, £201,500 in 19,900 preference and 20,000 ordinary shares of £5 each, and 40,000 deferred shares of 1s. each. Return dated July 23rd, 1929. All shares taken up. £121,500 paid (being £5 per share on the preference, £1 per share on the ordinary, and 1s. per share on the deferred shares). Mortgages and charges: £3,170.

Insulation Manufacturers, Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1928 (filed October 4th, 1929). Three shares taken up. £3 paid. Mortgages and charges, nil.

Tees Power Station Co., Ltd.—Satisfaction to the extent of £20,000 on various dates from April 1st to November 12th, 1929, of debentures secured by trust deed dated May 7th and registered May 24th, 1918, securing £600,000.

Thomas Wilkinson (Arnside), Ltd.—Satisfaction in full on November 6th, 1929, of debentures and mortgage dated April 7th and registered April 18th, 1922, securing £10,250.

Electrical Enterprise, Ltd.—Debenture dated November 14th, 1929, to secure £6,000, charged on land at Bungay and the company's other property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd. Particulars also filed of £2,450 debentures authorised November 13th, 1929, constituting a second floating charge on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Pinnacle Switchgear, Ltd.—J. G. Farquhar, 6, Minorca Road, Weybridge, ceased to act as receiver or manager on November 9th, 1929.

Thomas Hall & Son, Ltd.—Satisfaction in full on November 11th, 1929, of debenture dated July 19th, and registered July 24th, 1928, securing £10,000.

City Notes.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The annual meeting of this company was held on November 29th. Sir John Ferguson (chairman), who presided, said that with regard to Silvertown, not only had the increase in sales required not materialised, but they had had a much larger drop than had been the case in the previous year, and consequently economies in overhead charges had been more than swallowed up by reason of the lower turnover. The work of erecting the new steam and power plant was well in hand, and there was every indication that they would have the whole of the installation in working order by the beginning of December. The total sales showed a decrease of 11.4 per cent. With reference to the outlook for the current year no difficulty was likely to be met in at least equalling last year's general india-rubber figure. In connection with ebonite, a considerable turnover had been lost in consequence of bakelite and other mouldings having come forward, but they were slowly moving ahead, and orders had been secured and were being dealt with. The current year had started under somewhat more promising conditions than had prevailed twelve months ago, the work of a general character awaiting manufacture standing at 11 per cent. higher. Submarine cable work had practically dropped to zero. Regarding the activities of Persan during the year, after two consecutive years of very heavy loss, there had been an improvement within twelve months, equivalent to about £40,000. The year's trading showed a moderate profit, the first for a number of years, and the most substantial since 1920. The main elements in the recovery were that the turnover had increased by more than 12 per cent. and overhead charges had been largely reduced. After a period of relative inactivity in the wires and cables department they had recovered their share of the general market and of special contracts for heavier cables. Up to the present, their sales in the new year had shown a 30 per cent. improvement on the corresponding period a year ago, yet because of a shortage of labour that increased production scarcely kept pace with the growing volume of orders on their books. Plans for new equipment and for more economical re-grouping of existing plant were in hand, and there was every indication of a prosperous year ahead. The report and accounts were adopted.

La Plata Electric Tramways Co., Ltd.

An extraordinary meeting was called for Wednesday last for the purpose of approving a provisional agreement for the sale of the company's undertaking to an Argentine company, La Nacional. This is the outcome of the keen competition between the two concerns. Costly improvements are necessary and in existing circumstances the expenditure would prove unremunerative. The purchase price is £375,000, plus a certain sum for stores on hand. Of this £45,000 is to be paid in cash and the balance, secured by first mortgage 5½ per cent. debentures, will remain on loan for ten years. To meet the arrears of dividend on the La Plata preference shares (amounting to £133,000) it is proposed that the ordinary shareholders shall transfer 60 per cent of their holdings (£150,000) to the preference shareholders. The sanction of the Court will be required to effect this. To deal with the existing capital loss it is proposed to write down the £1 ordinary shares to 4s., thus reducing the company's capital from £450,000 to £250,000. Other resolutions relating to the compensation of directors, &c., were to be put before the meeting.

Aluminium Corporation, Ltd.

The annual meeting was held recently, Mr. Kenneth M. Clark, J.P. (chairman) presiding. The chairman said that during the year the associated company in Norway had regularly sent forward supplies of metal, and the rolling mills in North Wales had thus been enabled to keep going steadily. As a consequence of the fall in the price of metal, they had not derived as much benefit from the sales agreement with the Norwegian Company as was at one time anticipated. With the opening of the Maentwrog power station of the North Wales Power Co. and the conclusion of an agreement between the Power Co. and the Central Electricity Board for the future supply of electrical energy at a price with which they could not compete, it was decided to dispose of the hydro-electric portion of their undertaking to the Power Company. As a result of this transaction their finances would necessitate reconstruction, and the directors hoped in due course to put forward a scheme for reorganising the capital of the company. The report and accounts were adopted.

Official Notice *re* Companies.

The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Chippenham Electric Supply Co., Ltd.
Eureka Electric and Wireless Maintenance Guarantee Co., Ltd.
Hadem Wireless, Ltd
Melksham Electric Supply Co., Ltd.
Midland Electrical Tube Co., Ltd.
Trowbridge Electric Supply Co., Ltd.
Winchcomb Electric Light & Power Co., Ltd.

Buenos Aires Town and Docks Tramways, Ltd.

Presiding at the annual meeting on November 26th, Mr. B. H. Binder (chairman) said the tramway system comprised about 26½ miles of track, 71 motor tramcars and 22 trailers. The number of passengers carried totalled over 15,500,000, a small decrease of 189,000 as compared with the previous year; there would have been an increase but for the prevalence of labour disputes and competition from jitneys—a type of taxi-cab. The capital expenditure during the year amounted to £10,200, and included the purchase of five new tramcars. The programme of improvements included the provision of ten similar cars during the next 18 months. The report and accounts were adopted.

Stock Exchange Notices.

Dealings in the following have been allowed by the Committee of the Stock Exchange under Rule 159:—

Joseph Lucas.—125,000 ordinary shares of £1 each, fully paid, Nos. 819,301 to 944,300.

Underground Electric Railways Company of London.—2,254 ordinary shares of £1 each, fully paid, Nos. 7,275,068 to 7,277,321.

Radio Corporation of America.

The gross income for the quarter ended September 30th was $63,272,926, as against $23,643,332 in the corresponding period of last year. The surplus for the quarter amounts to $8,729,389, as compared with $5,221,145, raising the surplus for the first nine months of the year from $9,745,924 to $13,725,877.

S. Smith & Sons (Motor Accessories), Ltd.

The profit for the year ended August last was £164,793, against £160,987. The dividends on the preferred and deferred ordinary shares are maintained at 17½ and 37½ per cent., respectively, and the general reserve again receives £28,000. £10,000 is written off patents and £47,368 (against £43,079) is carried forward.

Electric Construction Co., Ltd.

In declaring the interim dividend on the preference shares (3½ per cent.) the directors say that they consider it prudent not to declare an ordinary dividend until the accounts for the full year are available. An interim dividend of 3 per cent. was paid last year.

United Electric Tramways Co. of Caracas, Ltd.

The net revenue to June 30th was £7,843, but owing to a loss of £8,857 on the omnibus system, the directors do not recommend the payment of a dividend. A balance of £53,698, which includes £45,854 brought in, is carried forward.

American Commonwealth Power Corporation.

The gross earnings of the Corporation and affiliated utilities to October 31st, amounted to $23,361,740. After payment of dividends on first and second preferred stocks, there is a balance for reserves, federal taxes and surplus of $3,434,261.

Chloride Electrical Storage Co., Ltd.

A dividend of 10 per cent., free of tax, has been declared on the "A" and "B" ordinary shares for the first half of the year, against 5 per cent. on smaller capital for the corresponding period of last year.

Consolidated Gas, Electric Light, and Power Co. of Baltimore.

A dividend of $0.90 per common share has been declared in respect of the quarter ending December 31st.

Globe Telegraph and Trust Co., Ltd.

Interim dividends of 3s. per share on the preference and 5s. per share, free of tax, on the ordinary shares have been declared.

Cambridge Electric Supply Co., Ltd.

An issue of 140,000 £1 ordinary shares at par is being made. The new shares are being offered in the first place to existing shareholders in proportion to their holdings.

French Companies.

The *Fil Dynamo, S.A.*, earned net profits of 705,000 fr. in 1928-29; the "A" shares receive 36 fr. each and the "B" shares 29.52 fr.

The *Etablissements Paz et Silva, S.A.*, report net profits of 2,138,000 fr. for 1928-29; the dividend is 15 fr. per share, as compared with 12 fr. in the previous year.

The Société Française Radio-Electrique reports a net profit of 3,459,000 fr. for the 18 months ended June 30th last. The dividend is 15 fr. per share.

The net profit of the *Société Electro-Câble* for 1928-29 was 11,670,000 fr. The dividends are at the rate of 10 per cent. on the old "A" shares, 5 per cent. on the new "A" shares, 11 per cent. on the "B" shares, 5½ per cent. on the old "C" shares, and 2½ per cent. on the new "C" shares. The distribution is made on a total share capital of 82,500,000 fr. as against 50,000,000 fr. in the previous year.

Burma Electric Supply Co., Ltd.

The net profit for the year ended July 31st last was £13,611, as against £13,995 in the preceding year. The final ordinary dividend is 2½ per cent. making 5 per cent. for the year (against 6 per cent.) and £7,246 is carried forward. The report states that earnings of the tramways have again been seriously depleted by competition from motor-omnibuses.

Atlas Co.

The alteration of the name of the Atlas Light & Power Co., Ltd., to the "Atlas Electric & General Trust, Ltd.," has received official approval.

Stocks and Shares.

TUESDAY EVENING.

STOCK Exchange markets complain of the paucity of business that obtains in all parts of the House, and this neglect on the part of the public has led to a weakening of prices in various popular sections, in spite of the expectation that the Bank Rate may be reduced to 5 per cent. before the end of the year. New York had three days' holiday last week, following three half-days of work, but when the Americans returned to business on the Monday morning of this week, the amount of trade which they found awaiting them did not seem to be anything great. At any rate, it was insufficient to exercise any particular influence over prices. The principal feature in our lists is a general fall amongst Underground Electric Railway issues.

Undergrounds Lower.

The prices of these issues show pronounced flatness, owing to the statement made by Mr. Herbert Morrison, on Monday, night, in the House of Commons, outlining the intention of the Government to excercise control over London transport. Mr. Morrison contended that what is required is "a far-reaching measure of unification under public control," which is a phrase that can be made capable of various interpretations. Until more definite information is given on the subject, nobody can tell what may be going to happen to the companies concerned in the business.

The Stock Exchange effect was a reduction in the price of Underground income bonds by 4 points to 103. The ordinary shares fell 1s. to 21s. 6d., Districts are 10s. lower at 72, and Metropolitans, which had been a good market previously at 62½, on the hope of an increase in the dividend next spring, reacted to 62. The absence of mathematical data proved too much for the market's nerves. So far as the tramway shares are concerned, no quotable alterations have occurred. The only difference is that, instead of the shares being negotiable with a fair amount of ease, the prices are now more or less nominal.

Electricity Supply.

Movements in the market for electricity supply shares have been this week mainly in the upward direction. The principal rise is one of 2s. 6d. secured by Clyde Valley shares, the price rising to 38s. 9d. on buying from the North. The Select Committee of the House of Lords that is charged with consideration of the Grampian Electricity Supply Bill, is making progress with its work. Metropolitan Electrics have thrown off part of the weakness which seized them recently, following upon the issue of new shares, and upon fears that earlier American purchasers of the shares would be forced to realise. The price has recovered to 37s. 6d., and the new shares, which a fortnight ago were changing hands at 1s. 6d. premium, are up to 5s. 9d. premium. Midland Counties new shares are also better at 9d. premium buyers. Yorkshire Electric show a rise of 1/16 to 33s. 9d. On the other hand, there are small falls in County of London ordinary at 48s., and in Brompton ordinary at 25s. 6d. Northamptons, at 44s. 6d., are the same as they were a week ago; Egham & Staines remain at 35s. British Light & Power shed the 9d. that they gained, going back to 13s. 9d., and Atlas eased off a little to 27s. 6d.; the preference shares are unchanged at 23s. 6d. Isle of Thanet are steady at 31s. 6d.; the preference, however, have fallen back to 23s. Prices of Australian and of Indian electricity supply shares show practically no alterations on the week.

Plenty of Money.

People who sold electric lighting shares some time ago, and have been carrying them over—"taking them in," is the technical term—find increasing difficulty in continuing these

loan-accounts from fortnight to fortnight. In other words, there is so much floating money available at the present time that buyers of shares have no difficulty in obtaining whatever accommodation they require. In fact, there is more cash seeking temporary employment than there are stocks and shares open for people who want to borrow money on the security of them. The net result is that, in spite of the season of the year, and the heavy falls which have occurred in prices during the past two months, capital in plenty is to be obtained, and at reasonable rates. The sellers of the electric lighting shares, to whom reference was made in the opening words of this paragraph, are being obliged to deliver their shares, the purchasers electing to take up the latter.

Telegraphs and Telephones.

Disappointment has befallen the holders of Cables & Wireless issues, the sharp improvement of a week ago proving to be no more than a flash in the pan, and being followed by a fall of 5 points in the company's " B " ordinary stock. This has reduced the price to 40½, comparing with 35 and 102 as the lowest and highest, respectively, of the current year. " A " ordinary has gone back 2 points to 79½. Estimates of a probable 5 per cent. dividend on this stock, in respect of the first year's working of the combine, are being modified downwards, and cautious people now profess that they will be satisfied if the dividend is 4 per cent. The full rate to which the stock is entitled is, of course, 7½ per cent. The likelihood of this being secured within the next year or so must depend upon the accession of business and reduction in expenses that, it is hoped, will follow the amalgamation of the Eastern cable companies, Marconi's, and the beam system. Marconi Marines are ¼ better at 46s. 3d. Baird Televisions strengthened to 6s., on the B.B.C. giving increased facilities for the development of the company's invention. Indo-Europeans are unchanged at 52½. Anglo-American stocks are steady. Amongst telephones, no particular change has occurred. Anglo-Portuguese are 1 1/16. Cuba Telephone 5 per cent. bonds drooped to 92¼.

Dollar Stocks.

Upon Wall Street's resumption of business early this week, the Americans, as already mentioned, appeared to be content to take things quietly, and there have been no fireworks in any of the leading specialities. Hydro-Electrics have moved fairly rapidly, going to 41½ before the price reacted to 36½, the latter showing a fall of 2 points on the week. A similar decline befell American Telephone & Telegraph stock at 228. International Telephone & Telegraph, at 73, is 3 lower. Talk of possibility that the Brazilian Traction, Light & Power Company may increase its quarterly dividend—the present rate is 2 per cent. per annum—led to demand for the shares, and, after dropping to 40, the price rallied to 42, which shows a fall of 1½. The preference shares, at 140, have parted from 10 of the 20 points that the price gained a week ago. Montreal Light & Power, at 120½, is the fraction better, and Shawinigan, at 78½, show a fall of 3½. Pennsylvania Water & Power, at 74½ are 8 lower. It is announced that the previously-projected schemes for hydro-electric development in Canada are to come into being as soon as the time is propitious. British Columbia has a programme involving the expenditure of 22 million pounds sterling, to be spread over the next half-decade, and estimates are made of the necessity for spending an equal amount in enterprises to consume the additional electrical output. The two companies chiefly concerned at present are the British Columbia Power Corporation and the West Kootenay Power and Light Company.

Mexicans are somewhat irregular. The 5 per cent. bonds of the Tramways Company are up 7½ to 72½, but Mexican Light & Power issues exhibit a dull tendency. The firsts and seconds have each shed 2, at 75½ and 69, respectively.

The Manufacturing Group.

Callender's Share & Investment Trust reports a net profit for the past year of £37,200, being an increase of nearly £10,000, and the dividend is to be 20 per cent., less tax, against 15 per cent. in the preceding year. The price of the company's 5 per cent. debenture stock is 96½. Callender's ordinary shares at 3¾ have risen ¼. Henleys retain their substantial gain at 5½, and the other members of the manufacturing group keep very firm. Siemens 10 per cent. preference shares, which are not always readily obtainable, can be bought, at the time of writing, to the extent of several thousands at 33s., this offering a return on the money of £6 1s. 3d. per cent, without taking into account the accrued dividend due next month. The ordinary shares remain at 26s. 3d. Electric Construction shares, although quoted at 15s. middle, have changed hands at 12s. 6d., and British Electric Transformer preference, nominally 13s., were sold a few days ago at 11s. 3d. Associated Electrical Industries ordinary shares, from 30s., eased off to 28s. 9d. General Electrics, however, retain their previous improvement at 46s. 3d. Telephone Manufacturing ordinary are 4s. 3d., International Automatic Telephone ordinary are 36s. 3d., and the latter company's " B " deferred shares stand at 35s. It will be observed that the price of the Victoria Falls ordinary shares has been added to our price lists this week.

Babcock & Wilcox shaded off to 62s., while Vickers remained tolerably steady at 7s. 9d. Rubber shares are dull, on the price of the produce having receded to a trifle under 8d. per lb.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Dec. 3 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	58/9	—	5 2 0
Brompton Ordinary	1	8½	8½	25/6	−6d.	5 9 10
Charing Cross Ordinary	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¼	8¼	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1½	+⅛	... ...
County of London	1	7	10	48/-	+9d.	4 3 4
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	68/8	—	4 11
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 2
London Electric	1	8½	9	27/-	—	5 1 10
Metropolitan	1	9	9	37/6	+1/-	4 16 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	28/-	+6d.	4 12 10
Mid. Elec. Power	1	15	8	33/9	—	4 14 10
Newcastle-on-Tyne Ordinary ...	1	6	6	29/9	—	5 1 1
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	1	8	8	26/-	—	5 7 8
Scottish Power	1	8	8	29/-	—	5 12 8
South London	1	8½	8½	25/6	—	5 9 10
Urban Ordinary	1	7	7	35/-	—	4 0 0
Westminster Ordinary	1	8½	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	33/9	+1/-	4 14 10

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	"	3	3½	61½	—	5 13 10
do. District	"	4	5	72	−½	6 19 0
Underground Electric	£1	5	7	31/6	−1/-	6 10 3
do. do. Income ...	Bonds	6	6	103	−4	5 16 6

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	99½	—	6 0 7
do. Def.	"	1½	1½	24¾	—	6 4 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5% Pref.	Stock	—	—	96	−½	5 14 7
do. A 7½ Ord.	"	—	—	79½	−2	... ...
do. B Ord.	"	—	—	40½	−5	... ...
Globe Tel. and T. Ord.	10	10	10	23	—	*4 7 0
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	29	—	6 0 9
Indo-European	25	10	10	52½	—	*3 16 9
Marconi-Marine	1	12½	15	2⅝	+⅛	... ...
Oriental Telephone Ord	1	12	12	21½	—	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8¾	+⅛	8 16 0
do. do. 2nd Pref. ...	5	6	6	8⅞	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	"	5	5	1425	+25	... ...
do. do. Pref. Ord.	"	8	8	120	—	6 13 4
Brazil Traction	100	7	8	42	−1½	4 15 3
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	87½	—	5 14 3
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	9/6	+6d.	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	72½	+7½	6 18 0
Mexican Light Common	100	Nil	Nil	75	—	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	76½	−2	6 12 5
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	8	—	1⅞	−⅛	4 3 4
Babcock & Wilcox	1	12	15	62/-	−6d.	*4 16 9
British Aluminium Ord.	1	10	10	46/-	—	*4 7 0
British Elec. Transformer Pref. ...	1	7	7	13/-	—	... ...
British Insulated Ord.	1	15	15	3⅝	—	4 0 0
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	3⅛	+⅛	4 0 0
do. 6½% Pref.	1	6½	6½	1⅝	—	5 4 8
Crompton Parkinson Ord.	5/-	—	80	20/-	—	7 10 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 9
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4⅝	—	4 2 0
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2⅛	—	4 6 7
Henley...	1	25	30	5½	—	5 2 0
do. 4½% Pref.	5	4½	4½	4⅝	—	5 6 8
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	36/8	—	5 10 3
Siemens Ord.	1	7½	7½	26/3	—	5 14 3
Telegraph Construction	12	10	10	23	—	5 4 2
Victoria Falls Ord.	1	15	15	2⅝	—	5 4 3

*Dividends paid free of Income Tax.

The B.E.A.M.A.

A Comprehensive Industrial Survey.

(*Concluded from page 966.*)

Prices and Profits.

International competitive efficiency is next dealt with, and it is shown that, allowing for a difference in wages, taxation, and a strict adherence to the 48-hour week, British selling prices would require to be 20 per cent. above the German, 2.5 per cent. above the Swiss, almost 40 per cent. above the French, and 50 per cent. above the Belgian, before the British manufacturer could hope to earn the same ratio of profit. In spite of these facts, the industry is not only meeting competition, but is actually increasing its hold, thanks to efficiency of manufacture and the technical changes which have favoured quality as against mass production.

An examination of the financial returns of thirteen firms covering 90 per cent. of the output of electrical and allied machinery is next given, and shows very clearly the results of the severe competition which has been met, and the narrowness of the margins by which success has been achieved. In four years these firms showed on the aggregate an increase in volume of output of 67 per cent., an increase in labour of 38 per cent., an increase in turnover of 2 per cent., and a decrease in net return of 18 per cent. Had no compensating factors been in existence such results would have meant little short of bankruptcy, but thanks to the improvements already referred to and a general re-organisation of the type now known as "rationalisation," all these firms have managed to win through. At the same time the financial position is far from satisfactory. The returns have become so low that there is a danger of losing those liquid financial resources which are necessary to handle large contracts, to say nothing of the expenditure required for research and development which is essential if a lead is to be maintained. The memorandum also suggests that Stock Exchange quotations for these firms' shares are not a reliable guide as to their prosperity, and represent at the moment about double the yield that is actually being obtained.

Export Trade Not Unsatisfactory.

In the section dealing with exports the vexed question of different prices in the home and foreign market is very fully dealt with. One reason given for the check in British exports generally since the war is that our foreign investments have been both lessened and changed in character, from investments giving control, and therefore influencing British purchases, to bonds and debenture issues and short-term credits carrying no control. Nevertheless, thanks to the enormous demand for electrical goods throughout the world and to the lead established in quality goods, our electrical exports increased by 130 per cent. between 1913 and 1928 (8.1 to 18.6 millions sterling) for a period during which the total world export of all electrical goods exactly doubled (37.5 to 75 million sterling). Making a rough division into machinery and apparatus, the latter has shown a much smaller increase than the former, due to the prevalence of mass production methods and low wage rates amongst our competitors. A detailed examination shows this still better, and brings out the quite spectacular increases in such things as switchgear and transformers (2½ times in 7 years).

A Study of Markets.

A territorial study then follows. Australia is now the most important British market for electrical goods, with India a close second, taking totals of approximately 3 million sterling per annum each. Next on the list come Argentina, South Africa, and New Zealand, with totals of from 1 to 1½ millions each. Dealing with our place among other exporters, a list is given of the five principal exporters of electrical goods from 1913 to 1928. Within this period Great Britain's total has risen from 23.4 to 27.4 per cent. of the total exports. Since 1924 there have been no spectacular changes and the three principal exporters, Great Britain, United States, and Germany, have each contributed something like 30 per cent. of the total.

A feature of recent years has been the recovery of Europe which is now the world's best market for electrical manufactures. Unfortunately for this country, most of the increase has been secured by the United States and Germany. In America's case this has been largely the result of financial penetration, as represented by investment in public utilities accompanied by control, and of the establishment of closer relations between American manufacturing firms and European subsidiaries. To a large extent, however, the increased trade which has been secured by these two countries has consisted of telegraphic apparatus, cables, and small mass-production items which are outside the particular aptness and interests of the British manufacturer. Outside the European market, America appears to be our chief competitor rather than Germany, and a detailed analysis of this competition is given.

The Effects of Reparations.

With regard to the increase in German trade in Europe, this is attributable largely to reparations. The reparations story forms an almost fantastic picture of the hollowness of victory and the folly of "making Germany pay." In order to pay her full reparations bill without dissipation of fixed capital and collapse of the mark, Germany would need to become the most prosperous and active industrial country in the world, with a steadily increasing export trade and with industries superior in efficiency and marketing success to those of all other nations. By paying partly in kind, as she is at present, she receives an enormous fillip to her export trade and gains an entry into markets which were at one time closed to her. Usually deliveries in kind are exported free of import duties on the part of the reparations country, or these duties are so reduced that they constitute a premium on German exports in competition with British or American. Moreover, although the deliveries on reparations account in 1929 amounted to only £2.2 millions, out of a total German export of nearly 23 millions, there is reason to believe that in many cases the equipment of a complete power station or line electrification was given to Germany merely because a small portion of the plant was on the reparations account. Chapter and verse for these statements are given in the memorandum.

The Importance of Exports.

Summing up the position it appears that British competitive position in every market was strong before the war; it was almost destroyed by the war and the process of recovery has been very slow in a number of markets. The comparatively strong position it now occupies has been reached only against the strongest competition and with the narrowest of margins, and feelings for the future may be described as doubt tinged with a kind of desperate optimism. Moreover, in electrical engineering this country depends to a greater extent than any other except Sweden upon her export trade, since exports accounted for 22 per cent. of our total electrical production, or 33 per cent. of the production excluding apparatus. The corresponding figures for the other chief countries are: United States, 5.6 per cent., Germany, 16.3 per cent., Italy and France, 12 to 15 per cent., Sweden, 50 per cent. Thus Sweden, alone of all these, has a higher export percentage than Great Britain, this being due to the restricted nature of the Swedish market.

The most hopeful possibilities would appear to lie in the development of new markets. The world in general outside of Europe, the United States, and the Dominions, has hardly yet begun to be electrified, and in this comparative stagnation lies the great opportunity of the British electrical manufacturer. South America, Asia, and Africa are awaiting the expenditure of new capital on essential development schemes, and it is for the British manufacturer, through power finance, Trade Facilities Act, or other mechanism, to supply that capital and initiative in opening up these markets.

The Growth of Electricity Supply.

Dealing with electricity supply as a market for electrical plant, the 1924 census showed that of the total prime movers in the country 53 per cent. were employed in the generation of electricity. This is admittedly a disappointing proportion, but it must be remembered that purely mechanical power had a long start. Thus in the period 1912-1924 the horse-power devoted to electricity generation increased by a greater amount than did the total horse-power of all prime movers, showing that electricity generation accounted for the whole of the growth in this period and even encroached slightly on other forms of power. By 1928 the electrical generating plant had risen to 59 per cent. of the total power production, a figure which still compares badly with that of the United States in which the proportion is approximately 78 per cent. In fact, even at our present rate of growth it will take us 14 years to reach the proportion now obtaining in America.

Of the power spent in generation in 1924, approximately 60 per cent. was for public supply, the other main groups being mines and quarries (13 per cent.) and iron and ship-building (10 per cent.) The rate of increase of generating plant has been of the order of 12 per cent. per annum, the line of increase having been practically straight in recent years. In parallel with this growth the country has seen a double revolution in the conversion to electricity as the main source of power, and the almost complete conversion to turbines as the form of prime mover. The motive for both changes has been increased efficiency, and both are almost entirely post-war developments. Thus the increase from 1907 to 1912 was only one million kW, and from 1912 to 1920 only 2 million kW, in spite of war activity and active Government encouragement, whilst the increase from 1920 to 1928 has been nearly 4 million kW.

The total growth of public supply from 1922-1928 can be expressed as an increase of four times in capacity and rather less than four times in output. This, although good so far as it goes, does not carry us even measurably near saturation, since America, who was admittedly in front of us in 1912, managed in the same period to quadruple her capacity and quintuple her output. The increase in electricity supply has been almost entirely in the sphere of public undertakings, private supplies having been practically stationary. The latter, however, still account for approximately one-third of the total as compared with one-sixth in the United States. The advantage which America enjoys in the home market for large power plant due to her rapid growth in supply stations, is shown by the fact that even with her heavy degree of electrification she installs fresh plant at the rate of over 2.5 million kW per annum, as compared with 0.65 to 0.75 million kW in Great Britain, and 0.75 to 0.85 million in Germany.

Industrial Electrification Possibilities.

A detailed examination is next made of the degree of electrification in different industries, and the total shows a proportion of something like 51 per cent. in Great Britain, as compared with 67 per cent. in Germany, and 73 per cent. in the United States. The differences are attributed not so much to trade depression in this country as to the deliberate load-building policies of American supply undertakings and the extensive rationalisation schemes in Germany. A very interesting table gives the leeway which has to be made up in various industries before satisfactory degrees of electrification are reached. This is expressed in the form of motor horse-power and totals about 5 million in all. The largest deficiencies appear to be in iron and steel (represented largely by the retention of reciprocating engines for rolling mill drive), in cotton (resulting from the predominance of the small undertaking with limited capital), and coal-mining, although in the last case the deficit has partly been made up since the 1924 Census figures. It will be seen that the electrical manufacturer has the very closest interest in anything which will bring back prosperity to these three depressed industries.

The next section covers an interesting world power survey and gives a detailed comparison between the chief industrial nations. The section concludes with a forecast of the growth in electrical demand which may reasonably be expected in the next twelve years from the different groups of consumers. As regards both railway electrification and the electrification of rural industries within this period the memorandum is frankly pessimistic. The final estimate for 1940 is 23,000 million kWh from public supply, and 5,500 million kWh from private industrial plant, as compared with the total of 10,400 million from all sources in 1923-24. At this point a degree of something like saturation would exist on the basis of the present structure and magnitude of industry. But industry itself can be expected both to expand and to become more complex. Fresh uses for electricity are continually emerging, and it is difficult to put any limit to potentialities. There is no reason why the country's output should not exceed 50,000 million kWh in the future rather than the 28,000 million kWh suggested as a preliminary saturation point.

The Electrical Future.

A chapter on the re-organisation of electricity supply deals with the background, both historical and geographical, and the stimulation of demand by supply authorities and development associations, whether carried out locally as in this country or by big national "pushes" as in the United States. The work of the Electricity Commission is then reviewed. The estimated reduction in the price of electricity, excluding distribution as a result of national schemes, is from 0.67d. to 0.4d. per kWh, and the total capital expenditure by 1941 is estimated at £100 million. Adding to this the expenditure by individual undertakings and on distribution plant, consumers' apparatus, &c., it is estimated that an annual sale of 80 million pounds' worth of electrical plant and apparatus should be guaranteed for the next twelve years or so. This total, however, should be more like £120 to £150 millions a year if a genuinely national movement towards electrification is to take place, and the problem is to stimulate the demand so that the consumption will justify the expenditure, and make the national system function to capacity.

The encouragement and possibilities of future electrification are next dealt with. It is claimed that it is not sufficient for the price of electricity to be brought down: capital is also needed to carry out the change, and where necessary there should be provision of capital at low rates with State guarantee. Many of the basic industries, which are only just covering essential debenture and loan charges and have no financial margins whatever, obtain credit with difficulty and are too occupied with self-preservation to have any energy for expansion. Nevertheless a process of reorganisation and rationalisation is already under way, and in a very short time a number of the power consuming industries will be in a position to embark on large modernisation schemes. This period of revival and reorganisation should coincide almost exactly with the completion of the main transmission system projected by the Central Electricity Board, and the latter should therefore be in a position to contribute towards the rapid electrification of those industries. Other much-needed improvements which would contribute to the same end lie in the electrification of railways, docks and other transport facilities, of agriculture, of village industries, and in a greater use of electricity for commercial and domestic purposes. In each of these cases statistical comparisons are made with practice abroad, and figures are given of the increased consumption which might be expected to result. The effect of foreign investments and the operation of the Trade Facilities Acts is also considered, and the necessity for State-aided centralised research is emphasised.

A final chapter deals with the future in a somewhat more philosophical manner. The aspects dealt with include the trustification of industry and the most efficient size of a manufacturing undertaking, the effect of deflation and the functions of economic research in industry. A great possibility is sketched out for the future of the Electricity Board as an index to the country's whole production and as a guide to, and director of, future developments of trade. There are three appendices dealing respectively with "International Electrical Export Statistics"; "Power Finance and Imperial Preference: the Example of Canada"; and "The Dominions as Markets for British Electrical Products." The last of these is fully illustrated with diagrams. It is safe to prophesy that the monograph will be a mine of invaluable statistical material for many years to come, and the whole industry is certainly to be congratulated very heartily upon its production.

Selling British Goods Overseas.

Notes on the Interim Report of the Committee on Education for Salesmanship.

THE Committee on Education for Salesmanship appointed by the last President of the Board of Education, under the chairmanship of Mr. F. W. Goodenough, C.B.E., has published an interim report (Stationery Office, 4d. net). This takes the form of a study of the essentials to success in selling British goods in overseas markets. Taking a broad view of its terms of reference, the Committee asserts that education for salesmanship is education for commerce on its creative, organising and executive sides, and covers the whole field of higher education. The question of overseas marketing was given first place, and considerable assistance has been afforded by the Department of Overseas Trade and the Chamber of Commerce organisations.

While it is agreed that many British firms have reached a high plane of salesmanship, it has become necessary to raise the average level. It has been said that it is bad policy to expose our deficiencies to the world, but concealment is considered even more damaging to British prestige.

The modern world presents a picture of intensified competition, for which the principal reason is the desire and capacity of nations who were dependent on others before the war, to produce what they require themselves; this has been accentuated by growing national consciousness—a desire to support home industries. The increased productive power of the United States is quoted as another important factor. The evidence showed that our foreign competitors, on the whole, have adopted very efficient selling methods in many markets. One result of competition is a wider range of choice for the buyer, which leads him to demand exactly what he wants. The effects of the war have led to a keener appreciation of low prices as against quality, which has militated against British products. British marketing methods appear to be too individualistic, and combination would probably lead to greater success. It is clear that not only is British quality appreciated, but British integrity has led to a definite preference for British goods in many directions.

The Committee takes the view that anybody who is concerned with the marketing side of the business, or is in a position to influence the satisfaction of the customer, is a "salesman." It is considered that employers should make better use of the first-class salesmanship material available. As for the actual salesman, he should possess the attributes of integrity, fortitude, patience, enthusiasm and courtesy. That elusive quality "personality" is also essential. An understanding of the customs and events of the country to which he is sent is very desirable.

It appears from the evidence that a good general education is preferable to specialisation for boys desiring to enter commercial life. This represents, broadly, at least a good secondary education or its equivalent, or, for some markets, a University training. It is always desirable and often essential for a salesman to have a good knowledge of the language

of his market; a special inquiry is being made into this subject by the Board of Education. Before a salesman is sent to a market, as well as while he is there, he must devote his energies to a study of that market. He should have a good general geographical knowledge, and it has been suggested that he might spend some time in the country concerned before definitely taking up his duties there. Similarly, firms should study market conditions primarily to discover whether success is probable; a preliminary visit should be paid by a principal or responsible representative of the firm. Another matter, which is taken for granted, is that a salesman should have a thorough knowledge of the goods which he sells. It is necessary for the pay and prospects (or status) of a salesman to be given consideration; salesmanship should not be considered "a minor sort of occupation." Again, the salesman overseas should be afforded the fullest support, and his reports should be given serious consideration.

A chapter is devoted to "Some Essentials of Successful Marketing Overseas." The importance of personal touch between the principals of a firm and its customers is again stressed, especially in markets in which agents are employed. The necessity for taking every possible step to meet customers' requirements is reiterated, and special reference is made to low-priced goods. Although the Committee deprecates any idea of a general lowering of British quality, the evidence of some witnesses suggests the possibility of considerable trade expansion in certain directions by this means. A tendency on the part of British exporters to delay delivery and correspondence is condemned. It is pointed out that strong and heavy packing is not always desirable, as Customs duties are often calculated on gross weight, and heavy packing adds to transport costs. It is necessary for an exporting firm to have a thorough knowledge of the trade regulations, Consular formalities, tariffs, &c., of various countries; information of this nature can be obtained from the Department of Overseas Trade. Not only should catalogues be printed in the language of the country for which they are intended, but in all transactions the currency, weights and measures of the country concerned should be employed. "No trouble" quotations are to be desired, giving the actual cost to the inquirer rather than the "f.o.b." price. The thorny question of credit is given consideration. It is said that, generally, the terms of foreign competitors are more favourable, and those concerned are urged to give the matter their closest attention. Another matter in which foreign competitors are said to lead frequently is "service," and the importance of customers being able to secure advice and spares "on the spot" is stressed. On the subject of the employment of agents, it is maintained that where an agency is necessary a certain amount of personal supervision should be exercised, although the agent should not be unduly restricted. This personal acquaintance should, if possible, precede any appointment; the engagement of natives of the country concerned is recommended. An agent should be offered reasonable terms if he is to be expected to take an interest in his work. A better use should be made of the publicity methods available, such as the Press, window displays, street hoardings, &c., and the Committee draws attention to the good results which may be obtained from participation in exhibitions. The evidence appeared to show that the means available for obtaining information (*e.g.*, the Department of Overseas Trade and Chambers of Commerce) are not sufficiently used.

In its conclusions the Committee considers that the outstanding weakness in British marketing overseas is "A detached and insular attitude and unscientific practice—relics of the time, long past, when we enjoyed a virtual monopoly of the world's markets for manufactured goods. For this weakness (again very broadly) the remedy is mainly to be found in a policy based on the most searching study of the character and needs of the market; on close, continuous and sympathetic contact with it, and on the guiding principle that the complete satisfaction of the customer is the basis of all permanent commercial prosperity."

Alternator Voltage Control.

Generator and exciter stability, and speed of response to control, under transient load conditions, with special reference to the large high-speed machines now being installed in capital stations.

By H. W. TAYLOR, M.I.E.E.

(*Extracts from a paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE problem of maintaining constant the voltage of a generator when large loads are frequently thrown on and off it is still met with in some mills and factories which, for good reasons, continue to generate their own power.

With power supplied from capital stations and the increasing size of systems, incidental variations in legitimate load have become relatively small, and only system faults constitute changes of load which require adjustment of the machine excitation.

As systems expand they are sectionalised, with interconnecting reactors between sections. When a severe fault occurs close to the generating machinery in one section it is unlikely that any practical design, or mode of operation, can maintain full voltage. Indeed, there is a difference of opinion among operating engineers on whether the excitation of the machines should be allowed to increase appreciably under these conditions. When, however, a fault occurs at a distant point, or in an adjacent section, it is usually desired to increase the excitation of the generators quickly to the limit of the exciter capacity, so as to maintain the supply voltage as near to normal as possible, at any rate on those sections of the system which are not local to the fault.

The magnet systems of large machines require larger stores of electromagnetic energy, which tends to lengthen the time needed to respond to changes in excitation intended to maintain normal voltage after sudden load changes.

Stability determines whether the drop or rise in voltage becomes cumulative after certain load-changes, and response determines the quickness with which, by a change of excitation, voltage can be restored when temporarily disturbed by load-changes.

Voltage control is nowadays required to be automatic within a few per cent. of the normal value, and the author's consideration of the subject is simplified by discussing, first, the exciter alone; secondly, the generator alone, and, finally, the two in combination as a generating unit.

The paper may be considered somewhat incomplete, inasmuch as it does not deal with the conditions which arise when the alternator is operating in association with other plant. Its object is to preach the gospel of the separately-excited (stabilised) exciter, improved by super-excitation, as compared with a shunt exciter. The last-named is slower than the separately-excited machine in voltage growth and response, as it depends for its exciting current upon its own voltage, which, at time of light load, is of relatively low value, whereas the separately-excited machine has always a high steady voltage with which to effect changes in exciter excitation. In order to make separate excitation of the exciter acceptable the practice has been initiated of building, as an integral part of the machine, a small service exciter which operates at constant voltage with a saturated magnetic circuit, and is, therefore, perfectly stable for exciting the main exciter. A neat arrangement consists of combining the service exciter in the same frame as the main exciter.

If an alternator is connected to a circuit which consists largely of capacity, *e.g.*, unloaded long overhead lines or underground cables, it may be self-exciting, owing to leading current in the stator windings acting as a magnetising current upon the magnetic circuit. The alternator will be inherently unstable in that the voltage may rise to a value which will be limited only by saturation, as sometimes occurs in high-potential testing when a smaller alternator is used to provide current for testing a large stator. On commercial circuits the effect has been noticed in some installations abroad, but it is not likely to be as troublesome in England, as (even when the country is linked together in one distribution network) the charging current will be small, compared with the load current, which will contain a lagging as well as a power component. However, it is suggested that operating engineers, when specifying power factor for their machines, should include the capacity current required in distribution, and that manufacturers should base the stator dimensions upon kW rather than kVA rating, and should use longer air-gaps when high power factors are specified.

Voltage regulators operate upon the exciter field circuit rather than directly upon the alternator field circuit, because it is not practicable to manipulate contacts carrying the large exciting currents of the latter. So soon as an increase in load causes an appreciable voltage-drop the regulator should short-circuit the exciter field rheostat, and continue to do so until normal alternator voltage is restored. In combination, the response of the alternator waits upon the response of the exciter, and an accumulative delay occurs in the restoration of the normal alternator voltage.

In calculating the combined response it is sufficiently accurate to take the average exciter response in terms of alternator voltage in the given change in load, and to associate it with the alternator time-constant for the new load; by this means, upon a change in load and with the exciter rheostat short-circuited, a curve of rising voltage can be plotted on the supposition that the increased alternator reaction for the new load is not effective. Three such curves can be derived; one for a shunt exciter, the second is for the same exciter separately excited, while the third is for super-excitation of the same machine at twice the exciter voltage. We thus calculate (1) the drop in voltage due to armature reaction when the exciter does not respond, and (2) the rise in alternator voltage due to the exciter if armature reaction were not effective.

We assume that the actual cycle of voltage variation after a change in load is the addition of the rise on the one curve to the fall on the other. Such average curves show a maximum voltage drop of 8 per cent. and a time of 3.8 sec. to restore the voltage completely to normal again in the case of the shunt exciter; for separate excitation the figures are 5.5 per cent. voltage-drop and 1.8 sec. for restoration, and for super-excitation 4.5 per cent. drop and 1.0 sec.

The vibrating-contact type of regulator provides for different exciter voltage at different loads by allowing its contacts to remain closed for a relatively long time at high loads and a relatively short time at low loads. For such a gradual increase in load as does not cause much alternator voltage variation the change in the character of the beat (that is, to a longer period of junction of the contacts with a shorter time of break between periods of contact) is also gradual and the average value of alternator field current increases with the load. With sudden increase in load and wider variation in voltage it is necessary that the regulator should temporarily short-circuit the exciter field as soon as possible after load is thrown on, which is effected in the vibrating-contact type by a cessation in the beating of the contacts. Any hesitation in the regulator in doing this will appreciably lengthen the time before voltage is restored and appreciably increase the maximum voltage-drop which will occur during this period. Again, because of the lagging of the alternator response behind the exciter response, the exciter voltage will temporarily overshoot the value required for the new load, but so soon as the alternator voltage is restored the regulator should commence beating in a suitable manner for the new load.

Discussion in London.

Four speakers only took part in the discussion, which fact prompted the chairman (Capt. J. M. Donaldson) to ask the author not to measure the meeting's appreciation of the paper by the length of the discussion. The paper was considered opportune in view of the policy of inter-linking now being carried out, and general agreement was expressed with the author's conclusions. Modifications of exciter system were mentioned with the object of imparting residual magnetism in order to improve stability and quicken response. A more precise definition of stability was needed to enable it to be measured from exciter saturation curves. The energy aspect should be kept in mind rather than that of voltage. To the advantages claimed by the author should be added that of altered outlook, for regulation was nowadays so good that it mattered little, and reactance assumed much more importance from the short-circuit point of view. In America to-day 200,000 kW was considered to be the limit of size of machine.

Electrical Trades' Benevolent Institution.

Annual Festival Dinner.

As was reported in our last issue, the annual dinner of the Electrical Trades Benevolent Institution was held at the Savoy Hotel, London, on November 26th. About 250 members and guests assembled under the festival presidency of Mr. Howard Marryat, M.I.E.E., M.I.Mech.E. The function amply achieved its dual purpose of incrementing the funds needed by the Institution for the pursuance of its laudable objective and of providing a pleasant social evening for those having at heart the alleviation of misfortune that has befallen men who have served a great industry.

Mr. H. MARRYAT, after the honouring the loyal toast, proposed the health of "The Electrical Trades Benevolent Institution." He appealed to manufacturers, wholesalers, contractors, and those undertaking the generation and distribution of electricity to provide the income necessary for the proper carrying on of the Institution's work. The electrical industry was the one bright spot in a period of bad trade. The funds in hand at the beginning of the year amounted to only £37,000, which had taken about 23 years to accumulate. This figure was less than many industries paid out annually in benefits. The minimum figure with which they could face their responsibilities for the future with security was £50,000. There must be many casualties in a big industry such as theirs. A helping hand in time had enabled many who had been in difficulties to occupy once again an honourable position. No cases of genuine distress had been left unrelieved, but the calls on the Institution's resources were increasing. Those suffering from incurable disease should be pensioned. It was proposed to broaden the basis of the financial position by seeking for contributions from the class most likely to benefit. The committee and the secretary, Capt. J. T. Keeping, had done splendid work for the Institution.

Mr. JUSTUS ECK, acting chairman of the executive committee, asked Mr. F. B. O. Hawes to accept from the committee, on the occasion of his retirement after 19 years' service from the position of honorary secretary, a suitably engraved seven-valve wireless set. Mrs. Hawes was also presented with a silver bowl and a leather case containing a series of appreciative letters. Mr. Eck, after extolling the devotion of Mr. Hawes to the work of the Institution, and touching upon his inventive capacity, read a letter from the chairman of the executive committee, Mr. E. A. Gatehouse, whose absence was occasioned by illness. The letter referred to the enormous debt owed by the whole of the electrical industry to Mr. Hawes for his hard work, of which only those who had worked with him could be fully aware.

Mr. F. B. O. HAWES, after expressing his thanks, said he hoped that the broader basis upon which it had been proposed to finance the Institution would not, by offering the inducements of benefits, cause it to become a "friendly society." While welcoming small contributions, they should also endeavour to obtain large individual donations; this would not be realised unless all contributions were voluntary.

Mr. LL. B. ATKINSON, in proposing the health of the President, paid a warm tribute to Mr. Marryat's courage and cheerfulness, and described him as "a getter of things done," and a man of many parts and hobbies, possessed of proper proportions of brains and brawn.

Mr. W. R. RAWLINGS, seconding the toast, said that Mr. Marryat had done more than any other man for electrical contractors, and that his reward was in benefitting those unable to help themselves.

After the president had responded, the company adjourned to the ball-room, where dancing continued until 2 a.m., with an interval for the auctioning of a seascape picture in aid of the funds. Mr. C. L. Arnold was the purchaser for £26 5s., and had the privilege of raising the total sum collected since the last festival dinner to a round £9,000—an amount considerably exceeding previous records. Due credit must be given to the secretary, Capt. J. T. Keeping, for his share in obtaining this fine result. Subsequent donations, we understand, have increased this figure still further. The thoughtful provision of blank cheques on the dinner table was responsible for bringing in no less than £925. The totals of the collectors' lists were as follows:—

	£ s. d.	£ s. d.
H. Marryat:—		
Personal	5,286 2 0	
per L. C. Penwill ...	72 1 11	
per E.C.A.	624 10 3	5,982 14 2
A. G. Beaver		16 16 0
C. H. Cox		81 15 0
"Distribution"		79 9 6
J. Y. Fletcher		546 2 9
Miss C. Haslett		18 5 6
H. Howitt		280 15 6
W. R. Rawlings		158 2 6
Major W. Roberts		17 13 4
E. E. Sharp		11 0 6
J. M. Sim		40 14 0
J. N. Stephens		218 16 9
L. Thurner		128 16 6
C. Wilson		184 19 6
E. Wilson		243 8 6
		£8,009 10 0
Dinner collection		925 0 0
	Total	£8,934 0 0

Included in the above were the following donations:—Mr. Dane Sinclair, £602, Mr. M. Frankenburg, £500, Merz and McLellan, £500, Sir George Sutton, £500, Sir Hugo Hirst, £500, Mr. J. A. Crabtree, £500, Sir Tom Callender, £500, Sir Harry Renwick, £250, Electrical Contractors' Association, £200, Electric Lamp Manufacturers' Association, £105, Whitehall Securities, £100, Mr. H. Alabaster, £100, Mullard Wireless Service Co., Ltd., £100, Holophane, Ltd., £100, Mr. W. R. Rawlings, £75, Mr. R. S. Whipple, £50.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

Improved Insulated Lampholders.

We have received from Messrs. J. H. TUCKER & Co., LTD., Kings Road, Tyseley, Birmingham, a sample of their "Telacite" insulated lampholders. One of the chief drawbacks of the bakelite lampholder, it is claimed, is that unless care is exercised in putting the lamp into the socket, it is an easy matter to break the liner, owing to the brittleness of the material. This is entirely obviated in the "Tucker" lampholder by a metal insert, completely enshrouded by the moulding material, thus rendering the liner as strong mechanically as any other part of the lampholder. Another point worthy

Fig. 1.—A "Telacite" H.O. Lampholder.

of mention is that the "Tucker" lampholders will accommodate the standard 1¼-in. hole shade, while a further feature is that the switchless holders are fitted with a special one-piece solid plunger as in the "Kwikwire" lampholder.

The cord grips are of a unique design; two self-adjusting cones in the top cap engage with the outer covering of the conductors and give an even and effective grip on any class of flexible. With heavy workshop flexible or c.t.s. cable, one cone can be omitted without in any way impairing the grip. In wiring, the cord-grip cap need not be removed; it is sufficient to slacken it back, pass the conductor through it to the wiring terminals, and then tighten up. In the skirted Home Office type, fig. 1, the necessary precaution has been taken of providing ventilation slots to disperse the heat generated by gasfilled lamps.

A Junction Box for "All-Insulated" Wiring.

For use with c.t.s. cable, so as to give an all-insulated wiring system, Messrs. SIEMENS BROTHERS & Co., LTD., Woolwich, S.E.18, have introduced a special tee or junction box, fig. 2. This is intended for surface use, and the rim which supports the base is provided with four 3-stage reductions to permit side entry for single, twin, or 3-core cables. The special advantage of this box is accessibility, due to the large central opening in the base which is supported clear of the fixing

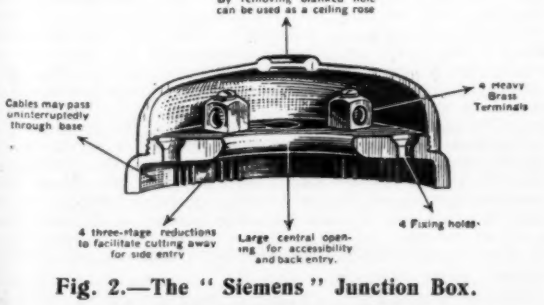

By removing blanked hole can be used as a ceiling rose
Cables may pass uninterruptedly through base
4 Heavy Brass Terminals
4 three-stage reductions to facilitate cutting away for side entry
Large central opening for accessibility and back entry.
4 Fixing holes

Fig. 2.—The "Siemens" Junction Box.

surface. By this arrangement cables can enter at right angles, tee, or four-way and, when required, can pass uninterruptedly through the base. By knocking out the blanked hole in the centre of the cover the box may conveniently be used as a ceiling rose. Porcelain connectors are not required, as the box is fitted with four heavy terminals.

A Remotely-operated Electric Lock.

At the recent International Exhibition of Inventions the first prize was won for an automatic electric lock, fig. 3, sent in by Messrs. E. W. PORCH and J. T. KNIGHT, of 222, Dalston Lane,

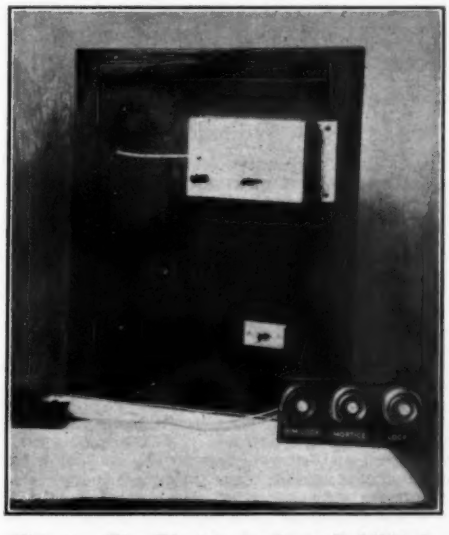


Fig. 3.—The Electric Lock as Exhibited.

E.8. It can be used on every kind of door. In the case of a bathroom a small push-button is placed just above the bath, within easy reach, and in the event of the button being pressed the door is automatically unlocked and an alarm bell is set ringing. The door can again be locked from the outside, and the bell can easily be stopped by the small knob on the lock. The lock works from a very small 2-volt dry cell. When the door is opened from a distance a small electro-magnet attracts the lever into an upright position, so allowing the spring on the bolt to force the bolt back into a retracted position; at the same time the bolt can make a contact to complete the bell circuit if necessary. When the door is opened in the usual way this contact is pushed away, so that the bolt falls back into a free aperture. By means of a slight addition the door could also be locked from a distance, a slightly larger battery being needed for this operation.

New Battery-charging Equipment.

Messrs. NEWTONS OF TAUNTON, 6, Grape Street, Shaftesbury Avenue, W.C.2, have recently placed upon the market a new

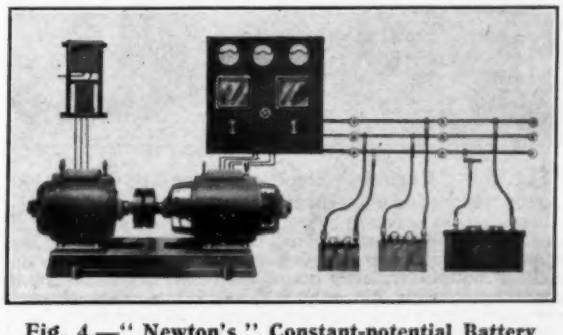


Fig. 4.—"Newton's" Constant-potential Battery Charger.

form of battery-charging equipment operating on the constant-potential system, fig. 4. This is a complete and self-contained equipment designed for charging portable accumulators of from 2 to 12 V. It is constructed for use from either d.c. or a.c. mains, and, if desired, can also be operated by belt drive from an engine or shafting. The equipment consists of an a.c. or

d.c. motor flexibly coupled on a combined bedplate to a patent compound-wound constant-potential generator. The generator can, if necessary, be arranged to be belt-driven by an engine or shafting. Sets are supplied complete with switchboards equipped with the necessary apparatus for the adequate control and complete protection of the plant and the battery. As the constant-potential method of battery charging enables batteries to be charged in parallel, busbars are incorporated to which the batteries are connected for charging, and an ample supply of flexible leads with spring connectors is also supplied for connecting these batteries to busbars. In addition, such accessories as flexible cable, insulators, high-grade miniature busbar ammeter, and complete starting gear are also supplied. Equipments are manufactured for charging 6-volt or 12-volt battery units from two busbars, and in addition a three-busbar set is supplied enabling 6- and 12-volt battery units to be charged simultaneously. The generator for the two-busbar set is provided with one commutator, and the voltage to be connected is 8 volts for 6-volt charging, or 16 volts for 12-volt charging. In the case of a three busbar equipment the generator armature has a double winding, and two commutators are provided, each 8 volts, the arrangement being that 16 volts is given across the two outer of the three busbars, and 8 volts across either outer and neutral. The sets are manufactured in sizes from 50 A to 400 A, for dealing with any number of batteries up to 640 per week.

Electric Incubator Heaters.

In the "Curfew" electric incubator heater of ELECTRIC INCUBATOR HEATERS, Curfew Poultry Farm, Chertsey, the electric heater is in the form of a tapped element, having a minimum resistance to give the maximum heat required and a maximum resistance to give the minimum heat required. The element is divided up electrically and tappings from it are taken to the studs of a control switch. A contact is arranged under the capsule rod of the incubator, this being connected across the two arms of the selecting switch. By this means, as the contact is operated one or the other of the two selected currents is always passing through the heating element, thus producing a very steady and constant heat. The current operated by the contact is very small, being only the difference between the two selected resistances, and as this is broken at practically no voltage, the circuit not being broken, there is no spark or arc on the contact. The current carried by the contact is arranged to be enough for the normal temperature changes of the incubator room. Another point is that the contact carries only a small amount of current, which controls a few degrees of heat each side of the heat required, so that should the capsule or contact get out of order or want adjusting, the incubator would be only a few degrees high or low, not enough to do harm. To vary the heat generated by the electric heater for the different seasons of the year, all

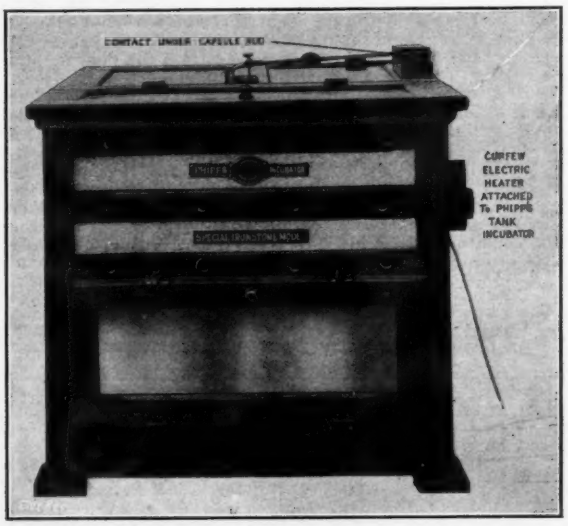


Fig. 5.—"Curfew" Electric Heater fitted to Tank Incubator.

one has to do is to turn the knob of the control switch. When the control switch is moved one stop, it does not take the contact control completely out of the range it was previously operating between, but only half way. The electric heaters are made for all types, sizes, and makes of incubators; fig. 5 shows the electric heater fixed to a tank incubator.

"Sadia" Switches.

Among the many products of SADIA, LTD., 22, Newman Street, Oxford Street, W.C., automatic time and cut-out switches form an important section. These include many interesting features. The apparatus consists of a precision clockwork movement with lever escapement and temperature compensation, fitted in the interior of an insulating dial ring and a transversely mounted drum switch, having inside the driving motor for the switch roller and for the automatic winding-up of the clock. Round the dial, which is divided in 24 hours, are mounted four movable contact rings. The hand of the clock carries a spring brush, first on one and then on the other of these rings, giving the excitation to the motor. This motor oscillates with the periodicity of the current. It has no commutator or sliding, and therefore there are no interruptions of current while working and no sparking. These oscillations are taken up by a ratchet drive, giving a rotary motion to the switch drum once the clock has been fully wound up. The clock has a reserve power of three full days. As the clock is always kept fully wound up, the pressure on the escapement is always even, resulting in perfect time-keeping. When an astronomical dial is fitted the switching on and off operations follow the curve of the sun throughout the year. The construction of the company's temperature switches is similar, except that a thermo-regulator is employed, providing an additional control. Fig. 6 shows the Z.S. type of time and cut-out switch.

New Switch-Fuses.

A recent introduction of the REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, is a 15-A, double-pole switch-fuse, fig. 7, suitable for 250 volts. It has a positive action, and the switch movement is well designed to give a quick

Fig. 6.—The "Sadia" Z.S.-type Switch.

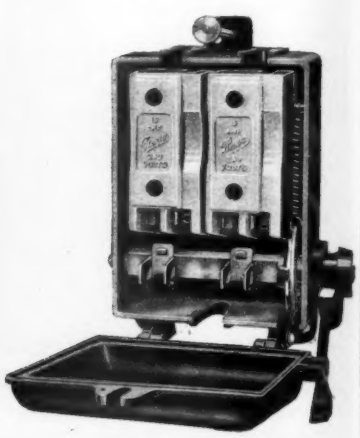


Fig. 7.—The S.6052 "Revo" Switch-Fuse.

make and break. Contacts of ample capacity are used, and these are shrouded in porcelain blocks, so as to ensure that arcing will not take place. The fuses are of the standard "Revo" quality which stood a dead-short test of 8,000 amperes, without damage to china, contacts, or case in a N.P.L. test. A new feature in the clean grey iron case is that slots have been provided at the top and bottom for cable connections, so that bushes are entirely eliminated. This robust switch should prove eminently suitable for small power and lighting installations, as it will stand, it is claimed, overloads for many hours, without overheating. Another new "Revo" model is the "Splitter" switch-fuse, which has been introduced to meet the requirements of those wishing to use a switch-fuse and two-way double-pole board complete in one iron case.

A New Cell Filler.

The CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, Manchester, has recently placed upon the market a handy cell filler which it has designed to reduce to a minimum the time and trouble taken in "topping up" cells of its "Exide-Ironclad" and "Exide" batteries with distilled water. This cell filler is particularly useful for situations in which the cells are rather inaccessible, since it enables the battery attendant to fill to the correct level, even when this cannot be watched, through the vent plug hole. When the liquid reaches the correct level a small lamp is automatically illuminated, and the operator then releases a pinch valve, thereby shutting off the further flow of water. By topping up the cells to the correct height, and no more, the density of the electrolyte is maintained at a regular value far more easily than is possible by the old uncertain method of filling up by a jug or syringe. All the cells in a battery can be topped up in this manner very rapidly, accurately, and without spilling water.

A Motor-car Battery Charger.

The RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester, has recently introduced a motor-car battery charger for operation from a.c. mains. It can be used on either 6- or 12-V systems, and it is unnecessary to disconnect the battery whilst the charger is in operation. The apparatus employs an "Elkron Igranic" rectifying unit, and has an output of 3 A.

Radio Communication.

A general outline of some of the progress made in radio-telegraphy and radio-telephony during the past two years.

By Capt. C. E. KENNEDY-PURVIS, R.N., M.I.E.E.

(*Extracts from chairman's address to the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

AN outstanding event was the fusion of wireless and cable telegraphy interests, which is all to the good. Wireless and cable services are complementary to one another for long-distance point-to-point communication. It would have been little short of a disaster for the cable services to have been pushed under. We are in an age of acute competition in communication, and every possible line must pull its pound. Cables have a distinct rôle to play, and after their long period of monopoly are being forced by stress of circumstances to push on with development and improve their technique. There is a mass of traffic to be picked up if rates are made sufficiently low, and it is up to the technical staffs, both cable and wireless, so to improve working and speed of traffic that rates can be cut and yet pay.

While the use of short waves for long-distance traffic is advancing by leaps and bounds, I venture to put in a plea that long-wave working should not be entirely abandoned. Congestion in the ether seems likely to be permanent and will probably always be ahead of technique. As additional lines are started up they will overlap such improvement as may be effected from time to time. It will be foolish to desert the development of the lower frequencies without exploiting them also to the uttermost. In time of war, even if we are neutral, short-wave working may become exceedingly difficult; a nation at war will not care much for conventions, and those countries which have kept long-wave services and their cables will have an advantage.

Radio-telephony is now a sound commercial proposition. Experiments in multiplex transmission, whereby one carrier is made to do the duty of one or more channels of telegraphy as well as telephony, show signs of promise, but it is a question whether the wave band occupied by such methods at present is not considerably wider than the sum of the wave bands which would be used by an equal number of separate stations. One important point which will require settlement soon is the encroachment of long-wave broadcasting on to the wave band allocated for air use.

Theoretical Advances.

A very considerable addition has been made to our knowledge of the theory of the propagation of waves, notably by the research work carried out in England under the auspices of the Radio Research Board and by the Marconi Company's research staff. The earlier theories of Eccles and Larmor regarding the mechanism of wave propagation have been largely confirmed by the experimental work of Appleton, Eckersley, and Hollingsworth.

Echo Effects.

Our knowledge of the echo effects produced at a receiving station on the shorter waves (which may give rise to the mutilation of signals) has been increased, and records have been taken with the cathode-ray oscillograph showing the arrival of waves which have travelled several times around the earth's perimeter. A very interesting prenomenon is the arrival of echoes after a very long interval of time (intervals of 15 sec. have been observed by Continental research workers). Whilst some workers are of the opinion that they are due to special conditions in the Heaviside layer, enabling the waves to pass many times around the earth, there is no adequate explanation at present of how the great attenuation one would expect in such cases is overcome. An alternative explanation is that such waves penetrate the earth's atmosphere and are reflected back by swarms, or bands, of electrons in space; this view has been put forward by C. Stormer. The echo phenomenon observed in short-wave reception has led to the development of directive aerial systems which tend to reduce the mutilation which the echoes otherwise cause.

Short-wave Development.

Short-wave development has been very rapid, mainly by the use of the higher-frequency regions for long-distance communication during the daylight hours. In general, the results obtainable at frequencies of from 21,000 to 30,000 kc/s are subject to very heavy fading; good communication has occasionally been established between Horsea and Hong Kong at a frequency of 25,000 kc/s, but in the case of frequencies greater than 30,000 kc/s there is no experimental evidence that they have long ranges over sea. The band between 15,000 and 21,000 kc/s has enabled communication to be obtained at long ranges over a very large proportion of the twenty-four hours by the judicious change of frequencies at various times of the year.

The success obtained with this frequency band is due not only to improvements in transmitting circuits and valves, but also in considerable measure to special forms of directive aerial systems. Apart from the Franklin vertical arrays as used at the beam stations, the most generally used types are perhaps multiple arrays of horizontal or vertical dipoles, but some interesting systems have also been developed in France by Mesny and Chiveir in which the array comprises wires arranged to form either a double zigzag or a Grecian key curtain, and for long-range working multiple arrays erected on masts of a height of less than 150 ft. have given satisfactory results. Commercially, the type of aerial array for a given service seems to be a problem of balancing power input and its cost against the cost of masts.

The Marconi Company developed its beam system for this frequency band; a service with South America is maintained by Germany at 16,500 and 11,500 kc/s; the Dutch Government has developed a considerable service between Holland and Java with frequencies of the order of 18,000 kc/s for day work and 10,000 kc/s for night working, variations being made from time to time as necessitated by seasonal changes. During the European summer period, particularly about June, practically continuous communication is maintained throughout the twenty-four hours of the day, but in winter higher-frequency communication is limited to some four hours of the day, though the lower-frequency period can be carried on for approximately 12 hours.

The British Admiralty has for some years been working a service to the east (Hong Kong and Singapore) at 8,570 kc/s, which has now been supplemented by a day-wave service at about 18,000 kc/s, and during June of this year a 24-hour service was maintained with Singapore at the latter frequency; during the winter months, however, the possible service is much reduced, but can be augmented by the use of frequencies of the order of 13,000 kc/s. The British Post Office uses 19,000 kc/s for trans-Atlantic telephony as an alternative to long-wave transmission; the B.B.C. broadcasts at 12,500 kc/s from Chelmsford (5 SW) and in Holland a short-wave transmitter near Hilversum broadcasts direct to the Dutch East Indies on the daylight wave band.

As regards British naval services, practically all H.M. ships have been adapted for short-wave working. Satisfactory results have been invariably obtained from the lower frequencies usually employed for the night services, but it is not so easy to do so during daylight. Although the use of short waves for mobile ship services is proving of great value, there is a certain limitation to their use due chiefly to the zone wherein either (*i*) interference is experienced between surface and indirect radiation from the transmitter, or (*ii*) there is a definite gap between these components of the transmission. The skip zone has been observed at sea on all frequencies above 6,000 kc/s at varying distances lessthan 1,000 miles. The band between 6,000 and 4,000 kc/s is very much better in this respect, but it cannot be said that short waves will meet the requirement of a continuous service for ranges up to 1,000 miles at sea to the same degree of reliability as long waves.

Apparatus Development.

As regards the energisation of valve anodes, high-voltage d.c. generators are used at the Rugby and some of the British Broadcasting Corporation's stations with satisfactory results. The alternative of single or multi-phase rectifiers is, however, in more general use for medium-power transmitters and especially is the use of double 3-phase rectification in favour. It has been claimed that the rectifier system gives greater security and reduces the tendency of valves to flash-over, but figures have been published to show that considerable economy results from the use of high-voltage d.c. machines for fixed station transmitters.

For the high-power medium- and long-wave transmitters the metal-glass valve with suitable cooling agents (distilled water or oil), has become well established; the silica radiation valve is also a very economical means of generating oscillatory power up to 20 kW, especially where space is limited. Con-

siderable experimental tests on metal-glass valves of increased anode rating have been carried out by the Post Office at Rugby, but the development of high-power standardised valve units capable of being used in parallel is proceeding more slowly than at one time appeared probable.

The inherent capacity of valves imposes a limit to the permissible inductance, and it is extremely difficult to design stabilised transmitters for very high frequencies. There is increased danger of puncturing the glass envelope, and it is usually guarded against by fitting an annular ring as an internal guard to screen the seal joint of the metal to the glass envelope. In Admiralty service very considerable success has attended the use of water-cooled silica valves, and two of them in regular operation are handling from 20 to 30 kW for services to the Far East at frequencies of the order of 18,000 kc/s. The ability of the silica envelope to withstand very high voltages at frequencies as high as 30,000 kc/s without danger of puncture renders it peculiarly suitable for the generation of oscillatory power at the higher frequencies.

The tuning-fork method of frequency control, which has been in use for some considerable time at the Rugby station and at various stations of the British Broadcasting Corporation, has proved to be an excellent system of high constancy; but the very large number of stages that would be required for controlling the short-wave band of frequencies is naturally a disadvantage, and for this reason short-wave transmitters are controlled either by master circuits, as used at the beam stations, or by quartz crystals. The latter usually have a fundamental frequency of the order of 2,500 to 3,000 kc/s, and stabilised transmitters taking h.p. inputs at their final stage of 30 to 50 kW are in operation using frequencies up to the sixth harmonic of the quartz crystal.

Quartz may perhaps not give such high constancy as a tuning fork; it does, however, operate exceedingly satisfactorily when the amplifying circuits are properly tuned and neutrodyned and is capable of giving a c.w. note of excellent quality, even in the case of relatively poor regulation of the anode and filament power supplies to the transmitter, or when a.c. supplies are used for the filaments. There is usually a change of frequency with temperature of the order of 30 parts in a million per 1 deg. C., and for this reason thermostatic controls are used, but it has been claimed by certain experimentalists that careful selection of the quartz cuts may reduce the variation to the order of two parts in a million.

There has been very marked advance in the design of broadcast receivers and their components. The large amplification factor of screen-grid valves and the large mutual conductive of the pentodes have made it possible to build relatively cheap three-valve sets having a performance at least equal to that of the more ordinary types employing four 3-electrode valves; they gain in case of handling, but need careful construction and screening in order to function properly. Valves with amplification factors of over a thousand are now available and, at the same time, they have a relatively small anode-grid capacity, compared with that of the 3-electrode valve. Despite the introduction of the many new and improved valves it is, however, fair to say that for frequencies above, say, 8,750 kc/s only slow progress has been made in the development of a system of genuine high-frequency amplification. For those higher frequencies the most successful methods of reception are still by (*i*) detector valve with reaction, followed by note magnification (the quenched type of receiver may be regarded as a modification of an oscillating detector), and (*ii*) superheterodyne.

For work in the navy both these methods have obvious disadvantages, since in their simplest forms they involve oscillations in the aerial with consequent interference between ships in close order receiving the same signal. The use of detector valves in push-pull and special methods of feeding-in the heterodyne do much to reduce the difficulty in the case of the super-heterodyne type of receiver. In the case of a detector valve with reaction, however, removing the reaction from the aerial tends to reduce the efficiency of the receiver to a very great extent. It is in this connection that modern screen-grid valves have proved of great value, for it is possible by the use of one of them in front of the detector to make up to a great extent for the loss involved in removing the oscillating circuit from the aerial. This make-up can hardly, however, be regarded as true high-frequency amplification, since what amplification is obtained depends almost entirely on the fact that the anode circuit of the screen-grid valve is oscillatory, and the addition of further stages between the valve and the aerial in which reaction is not applied may even result in a loss of signal strength.

The Merchant Marine.

The Washington Convention of 1927 has had the effect of forcing the gradual elimination of spark sets from ships. No new spark set may be installed of over 300 watts after January, 1930, and all existing spark sets must be reduced to 300 watts by 1940. Large ships now usually carry a set of about 2 kW for c.w. operation over a wave range of 1,000 to 2,650 metres and i.c.w. over a range of from 600 to 800 metres. Smaller ships are now being fitted with 600-metre ½-kW i.c.w. sets. Short-wave sets are growing in popularity and a daylight wave of about 26 metres and a night wave of 36 are commonly used. Direction-finding apparatus has been further developed chiefly by way of reducing the space required for aerials and increasing the wave range. The number of ships so fitted has very greatly increased.

Congestion Limitation.

The very large development of services on all bands of frequencies indicates how the overlapping of services is tending to increase resulting interference. The subject received a good deal of attention at the meeting of the International Radio Technical Committee at The Hague during September last, a few of the agreed items being the following:—It was recommended that the power of the transmitter should mean the power in the aerial itself; methods of its measurement were included. The definitions of waves, which are quite arbitrary, were fixed at:—Long waves=below 100 kc/s; above 3,000 metres. Medium waves=1,500 to 100 kc/s; 200—3,000 metres. Intermediate waves=6,000 to 1,500 kc/s; 50—200 metres. Short waves=30,000 to 6,000 kc/s; 10—50 metres. Very short waves=above 30,000 kc/s; below 10 metres.

It was decided that no absolute international standard of frequency is practicable at present; each nation was left to establish its own standard and to arrange for comparisons with other countries. The recommended tolerance for the various orders of wave bands used by different types of station was defined as the maximum admissible departure from the nominal frequency notified to Berne (no account being taken of the modulation) and agreed to at present as follows: for short waves of from 6,000 to 23,000 kc/s (*a*) fixed stations 0.05 per cent., (*b*) land stations 0.1 per cent., (*c*) mobile stations 10 kc/s, (*d*) fixed and land stations, of 250 or less watts output, 10 kc/s. The tolerances for the future, so soon as technique allows, are to be, respectively, (*a*) 0.01 per cent., (*b*) 0.02 per cent., (*c*) and (*d*) 5 kc/s, which apply only to fixed and land stations whose waves are actually notified. In the case of mobile stations the right to use any wave of the bands applicable was agreed to.

It was agreed that each nation should establish a national laboratory with a national frequency standard, each country to monitor the frequencies of its own stations. In this country the N.P.L. standard will be regarded as the normal one and the Post Office will do the necessary monitoring.

A channelling scheme was not agreed to, but the Committee recommended that, in the reserved fixed service bands below 50 metres, frequencies allotted in kilocycles should be divisible by 5; it was agreed that a separation of 5 kilocycles is not always sufficient at present, but that in practice a separation of 0.1 per cent. is practicable. Final recommendations included:—(*a*) Waves between 50 and 13 metres should be reserved for long distances, but may be used for moderate distances from two hours after sunrise until two hours before sunset. (*b*) Waves between 50 and 85 metres should be reserved for moderate distances. (*c*) Waves between 85 and 200 metres should be used for the shorter distances.

These recommendations refer to point to point working only and are only put forward as a general principle. It was also recommended that the power of European broadcasting stations using waves between 200 and 545 metres be limited to 100 kilowatts, Russia being except at her own request. The articles of the Washington Convention which forbid any increase of power of long-wave (above 1,000 metres) broadcasting stations, if such increase would cause interference with existing services (air), were reiterated.

Battersea Power Station.

The Elimination of Sulphur from Flue Gases.

THE White Paper issued by the Ministry of Transport, entitled the "Treatment of Sulphur Fumes in connection with the working of the proposed Electric Power Station of the London Power Company at Battersea" (Cmd. 3,442, H.M. Stationery Office, price 6d.), of which preliminary notice was given in these columns last week, contains two interim reports. The first is by Messrs. E. Ardern and R. V. Wheeler, advisers to the company, and is based upon experiments conducted by Mr. G. W. Hewson, chief chemist of the company, at the Grove Road power station.

It appears that when the Battersea power station is in commission the three boilers will yield a maximum of about 510,000 cu. ft. of flue gases per minute, containing 10 per cent. of carbon dioxide.

It is assumed that the flue gases from a coal containing 1.5 per cent. of sulphur will contain about 0.03 per cent. SO_2 and 0.05 per cent. SO_3 by volume.

Small scale experiments at the St. Pancras power station gave an indication of the character of the problem as one of "gas-scrubbing," the main practical consideration being whether the chimneys (and perhaps the flues) of the proposed plant will provide sufficient scrubber capacity.

Two facts are evident, having regard to the obvious desirability of reducing to a minimum the amount of water to be used:—(1) the time of contact between the flue gases and the water is all-important, and requires to be determined experimentally; and (2) the proportions of SO_2 and SO_3 in the flues gases require to be accurately known, for SO_3 can be more easily removed than SO_2. It is conceivable that,

either by treatment of the coal on the grate or by treatment of the gases in the flues, the formation of SO_3 can be encouraged.

Experiments on a reasonable working scale were put in hand at the Grove Road power station. The plant consisted essentially of a cylindrical absorption tower, 27 ft. high and 40 in. in diameter, with attachments for the delivery of the gases and water in contra-flow.

Two classes of coal, "Northumberland rough smalls" and "Scotch washed peas," were used. The former was of high (3.64 to 3.90 per cent.) and the latter of low (0.99 to 1.23 per cent.) sulphur content.

Tests with Cold Water.—The water entered the scrubber at 66° F. and left at 85° F. (average temperatures).

From the experiments it has been concluded that, when the time of contact of the flue gases with the wash-water is over 12 secs., there is complete removal of the sulphur gases, even when their original concentration is high, if sufficient water is used. As the velocity of the flue gases increases, the efficiency of removal of the sulphur gases decreases, but it is still high (90 per cent.) with times of contact as short as 7 seconds.

Tests with Hot Water.—The temperature of the gases leaving the scrubber must not be too low, lest there should be objectionable condensation of moisture, and downward flow when they met the air. Any downward flow might be avoided by delivering hot air near the top of the chimney stack to mingle with the flue gases after they were washed. The use of hot water might be equally effective.

The temperature of the water used averaged about 145° F. The temperature of the gases entering the tower averaged about 190° F. and their temperature on leaving was about 140° F.

The use of an excess of water (quantities up to 65 tons per ton of coal burnt were tried) was not advantageous, whilst a series of tests when low-sulphur coal was being burnt showed that as little as 6 tons of water per ton of coal burnt could effect a 90 per cent. removal of the sulphur gases (gas velocity 3.2 ft. per sec.).

A striking feature of the tests with hot water was the absence of any smell of SO_3 in the wash-water and of sulphites and thiosulphates. When using cold water this smell was always noticeable, and analysis showed the wash-water to contain sulphites.

Thus, by the use of hot water, the desired transformation of the SO_3 of the flue gases into SO_4 has been effected. The manner in which the transformation from SO_3 to SO_4 is effected, whether by the catalytic action of dust in the flue-gases or by the formation of ozone or hydrogen peroxide during the evaporation of the hot water, is still the subject of experiment.

The scheme for the treatment of the gases at the Battersea power station more than fulfils the requirements indicated by the Grove Road experiments, and allows for additional treatment, a final washing with a slightly alkaline solution. To guard against the emission from the chimney stacks of gases saturated with water-vapour, arrangements are to be provided for delivering hot and dry air to the stacks, either just above the "eliminator plates" (which will trap entrained moisture) or at any point higher up the stacks.

The neutralisation of the wash-water will be effected by mingling it with the "condenser" water, the volume of which will be about 40 times that of the wash-water.

An analysis of the mixture made at Grove Road gave the following figures in parts per 100,000:—Alkalinity (as $CaCO_3$), 15.30; sulphate (as SO_4), 3.70; total sulphur (as SO_3), 3.77.

The only alteration in the character of the river water would be a slight diminution of the carbonate content and a corresponding increase of the amount of sulphate present.

The Government committee agrees that the possibility of eliminating nearly the whole of the sulphur gas present has been proved. It considers, however, that a more definite explanation of the mechanism of the oxidation of sulphurous to sulphuric acid should be forthcoming before it can report on the practicability of the process. The committee adds that the alkalinity of the Thames near Battersea is about 20 parts per 100,000, and that 500 tons would have twice as much alkalinity as would be necessary to neutralise the sulphur acids from one ton of coal containing 1.5 per cent. of total sulphur, even assuming no sulphur to remain in the clinker. Thus, no acid effluent could pass into the river, and the possibility of calcium sulphite remaining in solution to deplete further the oxygen in the river could be overcome by changing it to calcium sulphate before the discharge of the effluent.

Modern Steam Generators.

High Efficiencies obtained at Power Stations of Simple Design.

IN his address to the London Local Technical Group of the Electrical Power Engineers' Association recently, Mr. Percy E. Rycroft, M.B.E., M.I.E.E., enumerated the fundamental essentials of a steam-raising plant as: reliability; the absorption of the maximum number of heat units liberated by the furnace, not only at its normal evaporative rating, but also at intermediate loads and overloads (without sacrificing this quality in favour of "flexibility," *i.e.*, a rapid response to slight damper adjustment); the minimum amount of adjustment during operation; and accessibility of the centres of adjustment. It was next necessary to meet the demands of the turbine builders for higher steam pressures and temperatures, and also to keep pace with the rise in the size of turbo-generator units.

From the Commissioners' latest returns—for the year ended March 31st, 1929—he tabulated the first hundred in descending order of efficiency. On the same table he added the type of steam generators installed and the system of firing adopted in each case, together with the annual load factor and the yearly output in units. The higher steam pressures were also noted where such were employed.

Broadly, the higher pressures were all located near the top, and, but for the fact that Padiham—the leading station—operated at only 250 lb. per sq. in., there would appear to be considerable evidence that the higher pressure plants had the advantage.

Large output and high load factor did not of themselves ensure good results. Beyond 20,000 lb. per hour, if it were assumed that the plant were properly worked, little or no difference in efficiency could be credited or debited to the size of unit.

The table showed a decided weight of evidence in favour of the sectional or header type of water tube boiler with horizontal tubes. Ferrybridge, as a newcomer with vertical heat tube boilers, was a notable exception to this rule, but had the advantage of a load factor of over 50 per cent., as against the 42, 44, and 46 per cent. of the first three stations on the list.

The predominance of the travelling or chain grate type of stoker was overwhelming. There was no station in the list completely equipped with pulverised fuel firing except Brimsdown B, which had not a full year's working to its credit; of the partially equipped stations, Barking and Lister Drive No. 3 made the best showing, but there was nothing to indicate the relative proportions of load borne by the pulverised fuel sections in either case. It could safely be said that so far no station had been carried into the front rank of efficiency by this method of firing.

The outstanding fact was that to all intents and purposes the main design and layout of the Padiham was identical with good practice of 20 years ago. Simple land type sectional header boilers with horizontal tubes and longitudinal drums, cast-iron vertical tube economisers set at the rear of the boilers, integral superheaters raising the final temperature of the steam to only 620 deg. F., a boiler working pressure of 250 lb. per sq. in., and a rated evaporation of 35,000 lb. of water per hour, giving the very modest rating of well under 4 lb. of water per sq. ft. of heating surface. The units were set in brickwork, and fired by means of mechanical chain grate stokers, operated for the most part under natural chimney draught conditions, with only 0.4 in. draught at the boiler dampers, and equipped with induced draught fans for emergency use only. The result for two years in succession had been an overall thermal efficiency of over 21 per cent.

The Barton boiler-house—which came second in the table—afforded a striking contrast to the simplicity of Padiham. In the nine original units two sets of horizontal tube sections were placed back to back, and connected into a common steam drum, the furnaces being also double, and fired at both ends. In later units this arrangement had been discontinued in favour of the standard single-ended type. Each complete unit was designed for an evaporation of from 100,000 to 120,000 lb. of water per hour. Steel tube economisers were superposed above the boilers, and tubular air preheaters were further superposed above the economisers. The complete plant was constructed for a working pressure of 375 lb. per sq. in., and the furnaces were equipped with chain grate stokers operating either with mechanical induced draught only or with combined forced and induced draught. The overall efficiency obtained by this plant over a considerable number of years were consistently good, and in 1929 was 21.31 per cent. The two essential differences between this plant and Padiham

were that at Barton air preheaters were installed, and forced draught utilised.

The third example of high efficiency plant was that at North Tees. This operated at the highest steam pressure so far employed by any British power station, *i.e.*, 475 lb. per sq. in., and had no economisers, relying entirely on air preheaters for recovering the heat units which passed the boiler. It was the first station to employ steam reheating between the turbine stages by returning the partially expanded steam to the boiler unit. The overall efficiency obtained in 1929 was 21.19 per cent.

The last of the high efficiency plant mentioned was Ferrybridge, the keynote of which installation, as in the case of Padiham, was simplicity. The boilers were of the vertical tri-drum type, with bent tubes, and each unit was complete with integral steel tube economisers placed immediately at the rear of the boiler. The working pressure was 300 lb. per sq. in., and the normal evaporation for each unit was 75,000 lb. of water per hour. Ferrybridge had a single-floor boiler house, with chimneys erected from the ground level, and no air preheaters. The furnaces were equipped with chain-grate stokers arranged to operate either with induced or with induced and forced draught.

Among the modern steam generating plant of to-day, the most efficient was at the same time the simplest in design, and the one which had departed least from well-established practice.

The outstanding feature of these new stations was the practically universal adoption of water-cooled furnace walls. This was one of the definite results of higher furnace temperatures due to more perfect combustion. A judicious blending of both metal and refractory surfaces was called for in order to obtain the best results, and the remarkable life which had already been attained by furnaces thus equipped rapidly covered the additional cost. Almost equally indisputable was the necessity for fitting all modern steam plant with simple equipment for the systematic removal of soot and fine ash from the heating surfaces. Apparatus was available which would readily collect all but the very finest particles of grit, and, by the added refinement of water sprays, the very finest could be dealt with satisfactorily. The power stations would very soon be able to recover at least 75 per cent. of all the sulphur they produced.

In this country technical opinion as to the advantages of pulverising coal for firing under steam boilers had undergone a considerable change during the last year or two. Central systems had given place to bin and feeder systems, and these in their turn had been superseded by direct firing plant. Long-flame vertical burners had been displaced by horizontal turbulent burners, and there had been many varieties of mills. While certain qualities of coal might advantageously be pulverised, it was equally certain that many of our coals could be burned at least as satisfactorily in a solid form by mechanical stokers.

A discussion followed in which Messrs. Wilson, MacGuire, Samuels, Oswald, Blenkinsop, Wallis, and Nunn took part.

Registration of Power Plant Tests.

A Plea for the Authentication of Data.

THERE can be little doubt about the importance of the subject dealt with by Mr. R. H. Parsons in his recent paper before the Institution of Mechanical Engineers, his object being to call attention to the need, which is felt by all engineers, for some official registration of authoritative tests of machinery. Such registration, it is believed, would secure to manufacturers the credit they deserve, would protect them to some extent from unfair competition, and would furnish designers and others with unimpeachable data as to what had actually been accomplished by particular machines. To carry out the work of registration it is proposed that an organisation should be set up, preferably under the auspices of the leading engineering institutions, and directed by men whose known competence and integrity would ensure general confidence in its decisions. The organisation should, in time, become self-supporting, deriving its income from fees charged for the consideration of cases submitted for registration and from the sale of its records. Such, in brief, is the scheme which Mr. Parsons examined in detail. The author has no intention, of glorifying test results in any way; if a test is regarded, as it ought to be, simply as a special performance of plant, conducted under strict rules, for the purpose of ascertaining its technical efficiency under stipulated conditions, it is not to be blamed because it cannot prove more than it purports to. Its limitations are obvious and freely admitted, yet the fact nevertheless remains that a properly authenticated test affords the only possible means of demonstrating that a machine, or plant, is capable of doing what its makers have claimed for it. They become, moreover, increasingly important as larger and larger units are considered and greater and greater sums of money are at stake. It is, therefore, as useless to belittle the value of tests as it is foolish to overrate it. The wise man does neither, his object being to ensure that the figures propounded shall be intelligibile and accurate. It is common knowledge how large a part test results play in commercial propaganda. The enthusiasm of the sales engineer is legitimate, and competitors will naturally be driven to adopt a similar procedure, for ordinary business ethics and commonsense forbid them to defend themselves by throwing doubt on the claims of a rival. Consequently they must strain every nerve to produce still better figures for their own propaganda, and so technical progress results and the standard of efficiency is raised, but there is always the danger of emulation causing promises to outrun performances. Every time a specially good test result is recorded by a firm competitors must endeavour to beat it, and the less scrupulous may yield to the temptation of claiming, without proper justification, even better figures, or at least of guaranteeing to get them. Those makers desiring to be honest and conservative in their guarantees find themselves at a disadvantage, lose orders they properly deserve, and see their prestige in design and manufacture passing to less worthy rivals. The evil could be met by insistence upon rigid tests to determine whether guarantees have been fulfilled, but who is to do the insisting? The customer can, but thorough tests are tedious and costly. What is wanted now is some means of securing general acceptance of such test figures as are worthy of belief, so that they could be reasoned from without their reliability being called into question. This, it is suggested, could be done most easily by the setting up of an official register, to the pages of which would be admitted only the records of properly authenticated tests of power-plant machinery, carried out and reported strictly in accordance with the requirements of a code.

It should be no part of the duties of the committee to express any opinion concerning a test, and especially any opinion whether guarantees have or have not been met. It would confine itself strictly to the task of registering the actual figures obtained, having first assured itself that they were reliable and conformed to the requirements of the code. It would be very useful if some impartial international committee of engineers could publish a register of properly authenticated tests carried out in all countries. The time for such co-operation has, however, not yet arrived. Let us get a register of our own first. Meanwhile the British register would, of course, be open to all foreign manufacturers who complied with British standards of testing and fulfilled the conditions imposed on their British competitors.

Legal.

Merchandise Marks Act Summons.

A SUMMONS under the Merchandise Marks Act, against Walter J. Edwards, Arthur N. Edwards, and Thomas D. Edwards, trading as Edwards Brothers, 20, Blackfriars Road, S.E.1, was heard at Tower Bridge Police Court, before Mr. Oulton on November 26th. Defendants were summoned for advertising cable for sale without indicating the country of its origin.

Mr. St. J. HUTCHINSON, representing the Cable Makers' Association, said he understood that the defendants would plead guilty. Under the Act of 1887 defendants were entitled to go for trial; the offence was actually under that Act although proceedings had been taken under the Act of 1926. Mr. A. H. OSMOND, for the defendants, asked the Court to deal with the case.

Mr. HUTCHINSON said that the Act laid down that if any person offered for sale any imported goods of any specified class or description without indicating their origin they were guilty of an offence. By an Order in Council made in 1928, insulated cable was brought under the Act and defendants should have shown in their advertisements either the place of manufacture or the word "foreign." They advertised "Grey Cable" as a cable passed by the Cable Makers' Association. This particular cable was advertised as a product of "Siemens Schuckert (Great Britain)," a German company, and people reading that description would come to the conclusion that the cable was made by an English firm. In pursuance of its objects the C.M.A. bought a length of the cable in question, which bore a ticket showing that it was manufactured by Messrs. Siemens-Schuckert, Berlin, and it also bore the mark "Made in Germany." If the cable had been purchased in smaller quantities there would have been nothing to show where it had been made.

MR. OSMOND said that his clients acted in ignorance. The goods were labelled according to the Act and also bore the words "German Manufacture." They had advertised only in trade papers.

MR. ST. JOHN HUTCHINSON said that defendants had been circulating the advertisement by post.

MR. OULTON said that the impression that the cable was of German manufacture would be removed by the words "Great Britain," which might be taken as an indication of the place of origin.

MR. OSMOND said that the words "(Great Britain)" were a part of the firm's title. It was only a distributing company.

Defendants were fined £2 each and ordered to pay £5 each as costs.

Farnworth v. Manchester Corporation.

JUDGMENT was delivered in the House of Lords on November 28th, by Lords Dunedin, Sumner and Blanesburgh, in the appeal of the Corporation of Manchester brought against the judgment of a majority in the Court of Appeal given in favour of Mr. Arthur Farnworth, a Barton-upon-Irwell farmer, who brought an action to recover damages for injury arising from vapours from the chimneys of the Corporation's Barton power station, and asking for an injunction restraining a continuation of the nuisance. Judgment was reserved on July 16th. A unanimous result was arrived at, though their Lordships came to the same conclusion by different means.

Lord DUNEDIN pointed out that the case had given rise to much difference of judicial opinion, and that its decision was not only of great moment to both the parties concerned, but its aspects brought up a question of the widest public importance, and it would be well indeed if it could be brought home, not merely to those interested in the development of the law, but to those who in the future were in the posittion which enabled them to settle and control the position of great electrical stations.

Their LORDSHIPS arrived at the conclusion that the appeal should be dismissed with certain modifications, and declared that the damages to be recoverable against the defendants should be such as had been sustained by the plaintiff up to the date when the injunction by the order awarded should have ceased to be suspended, or should have been dissolved, whichever event should first happen. That immediately after the injunction there should be inserted in the Order the following clause:—"With liberty reserved to the defendants to apply to a judge of the King's Bench Division to dissolve the said injunction (*a*) on their establishing, if it be not admitted by the plaintiff, that they have exhausted all reasonable modes of preventing mischief to the plaintiff; and (*b*) on their submitting in the future conduct of their power station to adopt and use the most effective of these modes until they have replaced them by other reasonable, but more effective, modes of prevention which may thereafter be discovered, and which will hereafter be adopted and used." That the first suspension of the injunction should continue for one year from the date of the Order of this House in lieu of one year from the date of the Order of the Court of Appeal.

Lord DUNEDIN moved that, with these modifications of the Order of the Court of Appeal, the appeal be dismissed with costs, and that the cause be referred to the King's Bench Division to act in accordance with their Lordships' declaration, the respondent to have the costs of the appeal to the House. It was ordered accordingly.

Compensation Claim.

IN the Shoreditch County Court, on November 28th, before Judge Cluer, there was an application under the Workmen's Compensation Act by Annie Catherine Clark, of 6, Kenninghall Road, E., for compensation for the death of her son, Thomas Clark, a fishmonger's assistant, who received a fatal electric shock at the premises of Mr. Alfred Cohen, of 7, Grand Parade, Green Lanes, Harringay, N. It was alleged that on July 11th he took up a white apron which had been placed on a line, and in doing so came in contact with an electric wire, and he received a shock which caused instant death. He had been receiving £3 a week, and the mother now claimed £300 compensation, as she was totally dependent upon his earnings. The defence was that the accident did not arise out of, or in the course of, his employment, and that the applicant was not totally dependent upon the earnings of the deceased man. Counsel for the applicant said that in the yard at the back of the fishmonger's shop there was a fence on which were run wires which worked an apparatus and supplied electric light for the fish cleaning shed. It was a custom of the men to put their white aprons on this to dry. The deceased man was seen sweeping in the yard, and he then must have touched the apron, for a few moments afterwards he was dead. His mother had been kept by the deceased, who gave her £2 a week. Evidence was given that the tubing had deteriorated, and the resistance was faulty. The maximum voltage was 240. Judge CLUER said he was satisfied that the proper inference to draw was that the man died from an electric shock, and he awarded the mother £300 compensation and costs.

A Partnership Claim.

BEFORE Judge Chapman, at York County Court on November 26th, George Baker, of Hampden Street, York, claimed £90 4s. 7d. balance due for money lent and interest, against Sydney Allen, electrical engineer, Burlington Avenue, York.

The plaintiff's solicitor said that in 1927 his client lent £200 to his son to be invested in an electrical business. The son put the £200 into a business with the defendant with a view to a partnership. Allen brought no money into the business, but he had some contracts. An agreement was drawn up providing that Ronald Baker should take 75 per cent. of the profits and defendant 25 per cent. until such time as their capital became equal. The plaintiff in the action was later approached by Allen to secure his agreement to a proposal that Allen should take over one-half of the capital liability, £100, so that the shares would be equal.

PLAINTIFF, in the box, said the money was lent in 1927. He received a total of £40 12s. 6d. from his son in repayment, and later issued a writ securing judgment for the balance of £159 7s. 6d. Subsequent to that judgment Allen called on him and wanted to borrow a further £100. A document was drawn up, but since it was signed plaintiff had received only £14 10s. from his son and a similar amount from Allen. The amount he now claimed was in respect of the balance and interest. Plaintiff further said that he had had nothing to do with the business, and had never received any money direct from Allen.

ALLEN, in the witness box, said he did not remember signing the original partnership document.

After examination of documents the JUDGE said he was satisfied that the signature was in defendant's handwriting. He found judgment for plaintiff for the amount claimed; and he gave further judgment for Allen as against the plaintiff's son in respect of a cheque for £57, paid on the dissolution of partnership, which it was alleged had been dishonoured.

Parliamentary News.

By Our Special Parliamentary Reporter.

The Grampian Hydro-Electric Bill.

Owing to the illness of Lord Clanwilliam, the Chairman of the House of Lords Committee, which is considering this Bill, proceedings upon it were recently suspended.

Consideration of the Bill was proceeded with last week, the Marquis of Bath presiding.

Mr. IAN MACPHERSON, M.P., gave evidence in support of the measure, and said that resolutions in favour of it had been passed by a number of neighbouring local authorities. He thought that once a cheap supply of electricity was available in the district, factories and works would be established there. Mr. H. RICHARDSON (formerly Dundee city electrical engineer) also gave evidence, of a technical character, in favour of the scheme.

Wireless Telegraphy and Broadcasting.

On November 26th, on the Committee stage of the Expiring Laws Continuance Bill (which continues, for another year, certain Acts which would otherwise expire), Capt. BOURNE moved to omit from the scope of the Bill the Wireless Telegraphy Act, 1904. He said that at the time the Act was passed no one dreamt that we should get such an elaborate system of broadcasting as we had to-day, that the entire authority should be the Postmaster-General as the licensing authority for all, and that he should actually depend on an Act of Parliament for an entirely different purpose. It was time that the Act dealing with wireless was brought up to date.

Mr. LEES-SMITH, the Postmaster-General, said that the 1904 Act had given the holder of his office an elastic authority by which he had been able to act quite effectively and fairly as "the policeman of the ether." It would be impossible to pass an amending Act this year. Also, it would be better to wait a little longer in view of the fact that there was to be an international wireless telegraphic conference in Madrid in two or three years, and that that conference was likely to adopt certain conventions which would need legislation in the Parliaments of the ratifying States, so that it might very well be that the Government would have to bring in a Bill on this subject in two or three years' time.

Viscount WOLMER then put a number of questions regarding broadcasting, the number of wireless licences now in existence, and the new station at Brookman's Park. He also asked for information as to the trans-Atlantic telephone service. He next referred to the Act, passed by the last Government, leasing the beam wireless services to the Imperial Communications Company. He asked if those services had actually been transferred to that company, and if any practical difficulty had been found in the working between the Post Office and the Company. Finally, he asked the Postmaster-General to tell the House something about the great disturbance which took place in the Atlantic recently. That earthquake, which put something like eleven cables out of action, proved what an excellent future the beam service had if it were fully developed. Had it not been for that service, the whole of the communications between this country and America, and, indeed, to all the countries from which telegrams were carried on from America, including Australia, would have been hopelessly congested for many weeks.

After further debate, Mr. LEES-SMITH said he did not intend to make any alterations in the system under which broadcasting licences were issued. The total number of such licences now amounted to 2,869,000; the number would soon reach 3,000,000, at which stage the Treasury took a larger proportion of the licence fees. With regard to the Brookman's Park experiment, the station there was working on a single wave, and the great change would come when it worked on the double wave. That stage would be initiated in a few weeks' time, but it would not be fully operated all at once. Probably it would be worked for half an hour a day, and then

it would be increased as the public became accustomed to the new development. The substantive agreements for the transfer of the beam wireless stations were signed on the day before the General Election last May. The transfer was now complete. With regard to the recent earthquake, both the cables taken over by the Communications Company had broken down, but the messages were transferred and carried by beam wireless, with the result that the service, although interrupted and delayed, was satisfactorily carried through. As to television, the negotiations that had taken place had resulted in the Baird Television Company obtaining the right to use the B.B.C. stations for half-an-hour on five days a week out of broadcasting hours. The Fultograph experiments had now come to an end.

The amendment was rejected, and the Bill afterwards passed through Committee and was read a third time.

Overhead Telegraph Lines.

On November 26th, Mr. A. Smith asked the Postmaster-General if, before the erection of overhead telephone or telegraph lines, he would consult with the local authority of the district, as in the opinion of some authorities overhead lines created a nuisance or destroyed the amenities of the neighbourhood, and were not as suitable as underground lines.

Mr. Lees-Smith replied that, in accordance with the provisions of the Telegraph Acts, the consent of the local authority was sought before any overhead line was placed in any public road under their jurisdiction and consultation, if necessary, followed. Due regard was paid to the question of amenities in framing applications for such consents, and the lines were laid underground whenever this could be justified financially.

The Transatlantic Telephone.

On November 26th, Mr. Lees-Smith informed Mr. Day that the total number of trans-Atlantic telephone calls during the six months ended October 31st was 7,737. The service was self-supporting, so far as Great Britain was concerned.

On November 26th, Mr. Lees-Smith informed Captain Cazalet that the net growth in the number of telephones installed during the year ended September 30th last was 123,409. The net increase in the number of residence telephones during the year was 50,428. The number of residence telephones at present in service was more than double the figure of five years ago.

The Battersea Power Station.

On November 27th, Sir Kingsley Wood asked the Minister of Transport whether he was now in a position to make a further statement as to the projected Battersea power station, particularly as to the Government's intentions on the interim report of the Government's chemists in relation to experiments on the prevention of the emission of oxides of sulphur.

Mr. Morrison said that the interim report had just been published, and it was proposed to await a further report.

Electrical Development.

On November 27th, Major Nathan asked the Lord Privy Seal if he was now in a position to state whether, in connection with the Government's plans for the reduction of unemployment, he had taken, or proposed to take, any action to accelerate the carrying out of the work of the Electricity Commissioners.

Mr. Lansbury, who replied, said that the Electricity Commissioners, in a circular recently issued, had urged all electricity undertakings to accelerate their expenditure on development so as to provide increased work in the next two years. The Central Electricty Board had also been requested to continue to press on with all possible speed with its constructional work.

L.N.E.R. Electrification.

On November 27th, Major Nathan asked the Minister of Transport whether, in connection with the Government's unemployment plans, steps had been, or were being, taken leading to the construction of an electric railway from Liverpool Street, *via* Bethnal Green, to Leyton and Waltham Cross, and to Ilford and Hainault Forest.

Mr. Morrison said that no proposals had yet been submitted to the Government by the railway company concerned for the construction of such railways.

East African Plans.

On November 27th, Mr. Hannon asked the Under Secretary of State for the Colonies if he could make any statement relating to the delay in the adoption of a scheme for the supply of electrical power in the Tanganyika territory; if his department had received any report on the proposed hydro-electric station at the Pangani River Falls; and if he would take steps to accelerate the project with a view to contracts being placed in this country.

Mr. Lunn said that negotiations were in progress with regard both to the general development of electrical power in Tanganyika and to a scheme for the production of electric power from the Pangani Falls. Every endeavour had been made, and would be made, to expedite the matter.

A Welsh Scheme.

On November 27th, Mr. Haydn Jones asked the Lord Privy Seal whether his attention had been called to the delay in extending the electric line from Maentwrog to Barmouth and other towns on the Welsh coast; and whether he would include this extension as part of the Government plan for the relief of unemployment.

Mr. Lansbury, who replied, said that the Barmouth Urban District Council, by an Act passed in July of this year, obtained authority to give a supply of electricity in an area including its own district, and was under obligation to lay certain compulsory mains for the purpose of giving that supply within a period of two years. The Electricity Commissioners had been informed that the question of the construction of the electric line from Maentwrog to Barmouth was now receiving the close attention of the North Wales Power Company, which was the body charged with the duty of affording bulk supplies of electricity. The attention of all electricity supply authorities had recently been drawn to the financial assistance which was available under the Development (Loans Guarantee and Grants) Act, 1929, in respect of carrying out works in acceleration of normal development. It was doubtful, however, whether the works referred to could be regarded as accelerated expenditure.

Special Orders.

Special Orders have been approved in respect of parts of the rural districts of Escrick and Pocklington, in the East Riding, Easingwold, Flaxton, and Malton, in the North Riding, and Great Ouseburn, in the West Riding of Yorkshire, and for the amendment of the York Electric Lighting Orders, 1890 to 1914; the borough of Congleton and the urban district of Buglawton, Cheshire; part of the parish of Weston, in the rural district of Runcorn, Cheshire; parts of the rural districts of Cuckfield and Chailey, East Sussex, and for the amendment of the Haywards Heath and District Electricity Special Order, 1922; in respect of part of the rural district of Aysgarth, in the North Riding of Yorkshire; the urban district of Wimborne Minster and parts of the rural districts of Poole and Wimborne and Cranborne, Dorset; part of the rural district of Salisbury, in the county of Wilts, and part of the rural district of Fordingbridge, Southampton; the burgh of Dunoon, Argyll; parts of the rural districts of Aysgarth and Reeth, in the North Riding of Yorkshire; and the parish of Downton, in the rural district of Salisbury, Wiltshire.

The Indo-European Telegraph Co., Ltd.

In the House of Commons, on November 28th, Mr. Thurtle asked whether, in view of its interest in Imperial and International Communications, Ltd., the Government had been consulted with regard to the company's proposal to purchase the Indo-European Telegraph Co., Ltd., and, in particular, to the offer to pay a large sum of money as compensation to the Indo-European Co.'s directors.

Mr. Snowden said that the Government had not been consulted. It was merely a partner in the Communications Co., and if any representations were made they would go to the Imperial Communications Advisory Committee on which each of the partner Governments was represented.

The Co-ordination of London Transport.

In the House of Commons on Monday, Mr. H. Morrison, Minister of Transport, made a statement with regard to the Government's intentions in the matter of the co-ordination of London passenger transport undertakings. The matter is referred to in a "leaderette" in this issue.

Correspondence.

Correspondents should forward their communications **as early as possible.** ***No letter can be published unless we have the writer's name and address in our possession.***

The All-Electric House.

In reply to Mr. F. J. Moffett, I am one of those engineers who realise that the heating of rooms and water supplies by electricity has a very considerable contra item to place against the "wastage of national fuel supply" argument. That item is the well-being, ease, and comfort of our women folk.

Personally, I have used coal, coalite, the gas fire, and gas cooker, so can claim some experience. The work required with coal or coke heating is considerable; for even the best coke-fired boiler requires cleaning periodically and ashes removing, whilst it is—whether Mr. Moffett likes the fact or not—assisting to pollute the atmosphere.

As for gas fires, well, when forced to use this type of heating, I purchased the best modern gas fire I could obtain, built it into the fireplace, and attached a 36-in. ventilator, fitted with a cowl, running up the chimney, from the top rear portion of the gas fire. The fire was very pleasant, very warm, and convenient; but—sitting near it for an hour induced sleepiness. This experience was common to the household—not only to myself. I have never yet found a room heated by gas fires in which I do not experience this unpleasant sleepy feeling; it was followed, in the case of my wife, by headache. When the opportunity came, the gas fire was converted by fitting two Belling elements. There is now no unpleasant drowsiness when sitting near the fire.

Another point must be mentioned. This last month I have changed houses. The only fire used in the old house for over

9½ years has been the kitchen fire; finding that there was a fair stock of coal in the cellar, the front room radiator was disconnected and coal fires used again. The difference in work and coal consumption is amazing; also, it may be emphasised that the work from which the household is relieved by the radiator is dirty and unpleasant, whilst the draughts set up by the brightly burning coal fire are quite noticeable, in contrast to radiator heating, with which no ventilation trouble happens. The radiator is set with its back to the hearth, but not blocking completely the ingress to the chimney. The plea that a coal or coalite fire is so much pleasanter is sentimental nonsense. The coal fire now does not appeal to me as pleasant, but as crude, dirty, and inconvenient.

Concerning the cost, for fourteen lights, two radiators, one 6-kW cooker, two bowl fires, one electric iron, one electric kettle (three-pint size) with the front door bell and wireless thrown in, my heaviest bill was, last December to March, £6 4s. 1d., including ratable value charge, and the hire of cooker and kettle. Energy used, 2,612 at ½d. per unit.

This period included the severe weather in the early part of this year. We located two critical places in our water system, and from 11 p.m. to 7 a.m. for sixteen days kept a bowl fire under each place. We were saved the mess and inconvenience suffered by our neighbours who did not work their houses "all-electric." Another point; the 750-watt bowl fire used for the upstairs pipe was used by my wife while retiring, then taken into the bathroom and put under the critical pipe, being taken again to the bedroom shortly after 7 a.m.

Can Mr. Moffett achieve such comfort and protection as cheaply and with as little work by his method? Can he start the gas engine up whilst lying in bed? And can he feed the central heating stove by closing a switch?

Coming to the gas cooker, well, I have yet to find the gas cooker which cannot be detected before one enters the kitchen. Gas cooking is convenient, but the fumes simply cannot be controlled and coaxed away so as to be unnoticeable.

No flues have had to be blocked up to warm the radiator heated rooms; a far better and more scientific method of obtaining adequate heat for a fair-sized room is to use two bars of a 3-kW radiator situated near the hearth, and a 750-watt bowl fire between the door and the radiator. One bar and the bowl fire will suffice in all but the severe weather.

When using gas and coal we required 6 tons of coal a year at a cost of £12 to £13, even when we were very careful. The winter quarter gas bill, after discarding the gas cooker, but retaining a griller, was always over £3, including cost of mantles and cleaning of globes and fittings, but not of cleaning out the service pipe to the gas fire occasionally. Electricity, all in, costs me about £15 per annum, and in addition £2 to £2 10s. has to be paid for coal and coalite for the kitchen fire.

I do not notice any charge for capital cost, upkeep, or depreciation in Mr. Moffett's accounts for lighting and heating, but merely coal, coke, firewood, and gas. Yet capital cost must be allowed for, and this with reasonable allowance for upkeep, insurance, and depreciation would be very low at £7 10s. a year. Lubricating oil is not mentioned, though I suppose it is included, and there is no allowance for (*a*) attendance in firing the boiler, (*b*) cleaning up necessary dirt, (*c*) cost of getting coke into cellar and shed. All the above items have to be paid for, either by the work of Mr. Moffett or his domestic staff.

This last month my wife and myself have found that to clean out, lay, and light one extra fire means half an hour's extra work per day, exclusive of coal carrying to the room so heated. In all, even with our small installation, we save £13 a year in domestic help, plus cost of food and breakages, while securing much greater freedom from unpleasant work in running the house.

In the house to which I have removed this month I have arranged to experiment with auxiliary water heating.

I am as anxious as Mr. Moffett is to end the process of destroying all the valuable constituents of coal in order to generate electric power; but I realise that the more electricity is used for all purposes by all people, the sooner will the carbonisation of coal be used to furnish gas and coke to generate electricity.

W. T. Wardale, A.M.I.E.E.

Sheffield, *November 25th*, 1929.

The interesting letter of Mr. F. J. Moffett will no doubt provoke a deluge of replies pointing out the well-known advantages of electricity for domestic purposes other than lighting. Mr. Moffett's costs are not complete, as he fails to debit his gas-coke system with the cost of storage of coke, attention to fires and the removal of ashes. His system also would necessitate resident domestic assistance at least throughout the winter months for attention to the coke-fired boiler. The majority of small post-war residences in suburban areas have, for reasons of cost, the minimum of space for domestic offices; hence the gas-coke system is ruled out in these cases, and can only be applied in more spacious houses where there is ample storage for coke.

The ultimate decision to be reached by informed individuals is whether the unquestioned extra cost of all electric domestic service is worth the great gain in convenience, freedom from dirt, &c. Personally, I think it is worth a good deal to eliminate such a poisonous compound as coal gas.

F. C. Platt.

Birmingham, *November 25th*, 1929.

E.D.A. Salesmanship Conferences.

With reference to Mr. F. A. Dracup's letter in your issue of November 22nd, I should like to point out that the attendance at the E.D.A. Salesmanship Conference on the 15th instant was undoubtedly adversely affected by the appalling weather which was experienced throughout the metropolitan area on that day.

I am sure Mr. Dracup will be interested to know that the attendances at the September and October Conferences severely taxed the accommodation available at the Royal Society of Arts; on both occasions over 200 people were present.

In spite of the fact that we are now in our tenth session of these Conferences, not only is interest sustained, but I am sure that we are increasingly appealing to the younger salesmen in all sections of the industry.

W. A. Vignoles,

Director and Secretary,
BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION, INC.

London, *November 28th*, 1929.

The Refrigeration of Electrical Apparatus.

In 1910 I offered to read a paper on the "Ventilation and Cooling of Electrical Machinery" to the Institution of Electrical Engineers, but it was returned to me. In that paper I dealt with some of the problems raised by Mr. Neu (see ELECTRICAL REVIEW of November 22nd, under the heading of this letter).

I afterwards published the proposed paper in book form ("Ventilation of Electrical Machinery": Whittaker). On page 62, line 12, I wrote: "Oil-cooled transformers of the static type might with advantage use them (refrigerators), &c." I gave figures of approximate cost, &c.

Since that date a great many lengthy and uninteresting papers on this subject have been accepted and published by the Institution.

My book at the time was criticised as though I had been guilty of a criminal offence.

W. H. F. Murdoch.

Sevenoaks, *November 22nd*, 1929.

Two-part Tariff Prepayment Meters.

I have read with interest the description of the "Rex" fixed charge automatic collector and prepayment meter and, as I have been interested in this type of meter since I first saw it in use at The Hague in 1925, I would offer the following remarks on this meter, as compared with the A.E.G. meter which has been on the market for some time.

(1) The "Rex" meter, having only a mechanical device to deal with the fixed charge automatically, cannot do so entirely.

(2) When a coin is inserted, a definite fraction (one half) is commandeered to cover the kWh consumption, even when the fixed charge has *not* been paid.

(3) The A.E.G. meter, on the other hand, has a small constant-speed electric motor connected across the mains, which continuously runs back the prepayment mechanism at the prescribed fixed-charge rate, and this is entirely independent of the current consumption.

(4) The switch in the A.E.G. meter trips the moment the consumer begins to be in arrears of the "fixed charge."

(5) The switch also remains open until a sufficient number of coins is inserted to cover the amount of arrears as shown on the register.

In the whole, the A.E.G. meter strikes one as a miraculous piece of apparatus, especially when the simplicity of the gear is considered.

There is no question in my mind, as Mr. Horwood in his letter in your issue of November 22nd says, that the A.E.G. meter supplies a real "two-part tariff prepayment" meter as near as the human mind can devise.

H. W. Watts, *Lt.-Col.*

Epsom, *November 25th*, 1929.

Standardisation of Sizes of Advertisement Pages.

The following is a copy of a letter that I have addressed to I.S.B.A.:—

"We have noted with pleasure in a number of trade and technical journals in which this company takes advertising space the publication of the I.S.B.A. letter on the subject of the standardisation of advertisement page size. We accordingly write to express our approval of the standards proposed. Whilst we should have preferred only one size, namely, 10 in. by 7 in., we appreciate the difficulties that this would mean to certain publishers, and therefore agree with the proposals that when a larger or smaller size is essential, it should be in the same proportion. The two additional sizes suggested should, we think, meet the requirements for such cases.

"This company feels very strongly that the adoption of standards in advertising space is a reform long overdue. The money spent on designs and blocks of varying sizes is waste which can, and should be, avoided.

"The publishers in the long run stand to gain by the proposals, as by their adoption, advertisers would be enabled to

cut out the waste expenditure from their allocation and thereby take additional advertising space."

J. Taffs,

Advertising Department,
English Electric Co., Ltd.

London, *November 29th*, 1929.

You invite comment on the letter inserted in the Review under the above heading.

As an advertiser, I agree entirely with the suggestion, and look forward to the time when I can use the same size printing blocks in all technical journals; also, as I pay £N for 84 sq. inches of space, I look forward to the obvious reduction to 70/84ths of £N to which I shall be entitled (query mark, fresh paragraph).

The only fly in the proverbial ointment is, will the I.S.B.A. purchase new machinery for the Electrical Review? Personally, the writer prefers a little larger printing space than that advocated, say, 10¼ in. by 7¼ in.

J. S. Simmons.

London, *November 29th*, 1929.

[So far I.S.B.A. has given no indication with regard to the provision of new machinery. We hope, however, that trifles of that kind will not deter readers and advertisers from expressing their candid opinions.—Eds. Elec. Rev.]

I cordially endorse the views contained in the letter from the Incorporated Society of British Advertisers. The infinite variety of sizes of technical publications is for advertisers an infinite nuisance. The waste of money on blocks and often on new layouts has been fully emphasised, but it does not even end there. Space has to be found for them, and extra labour is involved in keeping charge of them—three or four blocks being required where one would otherwise suffice. Personally I think 10 in. by 7 in. the most convenient size.

P.p. E. C. Reed, M.S.

London, S.W.1, *December 2nd*, 1929.

Determining Efficiencies by Slide Rule Calculation.

Mr. L. J. Vann's method of determining efficiencies within close limits by slide rule calculations certainly gives very accurate results, but I venture to suggest that the following method, although similar, is of a more simple nature.

$$\begin{aligned} \%\ \text{efficiency} &= \text{output} / \text{input} \times 100 \\ &= \text{input} - \text{total losses} / \text{input} \times 100 \\ &= (1 - \text{total losses} / \text{input}) \times 100 \\ &= 100 - (\text{total losses} / \text{input} \times 100) \end{aligned}$$

The expression Total Losses/Input×100 corresponds to Mr. Vann's expression Y in the worked example.

The efficiency can be read direct from the slide rule without mathematically subtracting Y from 100 by the following method :—

Against the value of the total losses on scale D set the value of the input on scale C, and the per cent. efficiency is read direct on scale D opposite 1 on scale C, by reading from right to left designating 10 as 90 per cent., 9 as 91 per cent., 8 as 92 per cent., &c., 2 would therefore be read as 98 per cent.

If using the values of the losses of the 5,000 kVA transformer as given by Mr. Vann, the working would be as follows :—

Load...		4/4	3/4	2/4	1/4
Iron loss	kW	14.0	14.0	14.0	14.0
Copper loss	kW	46.0	25 9	11.5	2.9
Total loss = x	kW	60.0	39.9	25.5	16.9
Output	kW	5000.0	3750.0	2500.0	1250.0
Output + losses = input = y	kW	5060.0	3789.9	2525.5	1266.9
% efficiency (x / y)		98 813%	98.948%	98 99%	98.669%

If the efficiency is below 90 per cent. the above method is employed, but with the exception that, when reading the efficiency on scale D, it is necessary to designate 10 as 0 per cent., 9 as 10 per cent., 8 as 20 per cent., &c.; 2 would therefore be read as 80 per cent.

F. A. Manley.

London, S.W.1, *November 24th*, 1929.

The description of a method for obtaining efficiencies on the slide rule rather different from that given in the Electrical Review of November 22nd may be of interest to your readers.

By this method, although efficiency is obtained by the setting of the rule, efficiency may be read direct by means of the simple expedient described below. To take a simple, if extreme, case. Let the input be 1,500, and the losses 500, giving, obviously, an efficiency of 0.666 (66.6 per cent.). Against losses (=500) on scale D, set the input (=1,500) on scale C, and we have (1−efficiency) (=0.333) on scale D against the index of scale C.

If, however, we reckon from the *right-hand* end of the scale, taking 1=0, 9=1, 8=2, and so on, we read, at this point, 0.666, which is the efficiency. The mathematical proof of the method is extremely simple and is as follows:—

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}}$$

and $1 - \text{efficiency} = \frac{\text{Input} - \text{Output}}{\text{Input}} = \frac{\text{Losses}}{\text{Input}}$. Losses divided by input is, of course, obtained by the operation described above. By reading from the right-hand end of the scale, we are performing the operation: 1−(1−efficiency), giving efficiency.

Another advantage of the method is that the higher the efficiency, the greater the ease and accuracy with which the result may be read. This is due to the fact that the whole of the D scale may represent any of the following ranges:—(*a*) 0 to 0.9; (*b*) 0.9 to 0.99; (*c*) 0.99 to 0.999, &c. In practice, of course, the range within which the result lies will probably be known, but in cases of doubt, the point can readily be determined by a simple division (Output÷Input) operation.

W. H. Watkins, Grad.I.E.E.

London, *November 25th*, 1929.

[Letters to the same effect have also been received from "Engineer" and "Efficiency."—Eds. Elec. Rev.]

The Countryside and the "Grid."

Much has been written and said on behalf of the nature lover against the erection of the steel pylons carrying the new high-tension electric cables in certain parts of the country, particularly the Sussex Downs and the Lake District, and already some emphasis has been laid on the apparent invisibility of the light, almost spidery-looking structures in comparison with the solid, clumsy, unbeautiful, and in many cases, carelessly arranged telegraph and telephone poles of the Post Office Department. These are allowed to wander aimlessly around the landscape, and even encroach on private property, without regard to the ordinary amenities of appearance. How many of our otherwise beautiful country roads are disfigured by the long monotonous rows of stout wooden poles, with no attempt at camouflage or concealment. In fact the wires wander first on one side and then on the other side of the same road, suggesting a total ignorance of any æsthetic temperament.

But as soon as the Electricity Commissioners startle the ordinary public with their utopian schemes to supply the rural countryside with cheap electricity, every little society is up in arms defending its own particular corner. The pylons themselves cannot be described as ugly, but they are, of course, very obviously not products of nature, and in consequence may not appear exactly as an essential part of the wind-swept pines on the skyline, or the rolling grass-covered expanses of the downlands. The regular spacing which has been adopted is, however, restful, while even at close quarters the long graceful loops of the hanging wires cannot be classed as essentially ugly. At reasonable distances the wires become practically invisible, and the pylons take on a fine delicate outline, suggestive of the tracery of a spider's web.

Some attempts might be made to fit in these essentials to progress with the peculiarly critical outlook of that section of the clamouring public. Experiments might be carried out with varying colour schemes, with a view to discovering the most satisfactory colour for each locality. In some districts the present neutral grey tint is an excellent camouflage, particularly in parts of Derbyshire, and it is at times difficult to detect the distant line of pylons in such places. In others, possibly, a green, or blue shade would be effective. On the other hand, while the horribly mottled effect of the old army camouflage would, no doubt, fit in with certain districts, it is hardly possible that such a scheme would meet with universal approval and would be distinctly disfiguring at close quarters. Again in certain selected areas evergreen shrubs of a suitable type might be planted in a close clump round the base of the pylon. In a few years these would grow, completely blotting out the foundation work, and the lower three to six feet of the structure. The orderly clusters of growing shrubs, even at a distance, would give a pleasing effect, and, by drawing attention away from the upward projecting wrought ironwork of the pylon, assist in further disguising the transmission line.

It is, however, fairly certain that the greater portion of the criticism is a passing phase only, and will have faded into oblivion in a few years' time. Little is heard at present times of the disfiguring effect of the railways, although one has only to look at the sea fronts of some of the North Wales and Devon resorts, to realise how brutally ugly a railway can be made to appear in unsuitable surroundings. It must not be overlooked that some of the criticisms are merely the out-pourings of that section of the community which detests modern progress of

any kind. One has only to recall Stephenson's witty retort with regard to the trespassing cow to realise that the conscientious objector is always in our midst.

F. E. S.

November 17th, 1929.

I am rusticating—out of sheer necessity, not because the English countryside offers many attractions at this season of the year.

However, I manage to maintain contact with civilisation. I open my newspaper, and a striking headline catches my eye. I read that Germany's exports are increasing by leaps and bounds, whereas ours are increasing only by an insignificant proportion.

What is the reason? Is it our inferior salesmanship, as so many industrial leaders have reiterated so often during recent years? There is no doubt that to a great extent we still adopt antiquated methods, are bound too strongly by tradition, and take refuge too frequently in the optimistic declaration: "We shall blunder along somehow."

Whilst I rusticate I think, and to me it seems that the small village in which I am staying is symbolical of the whole position of British industry. I take up my stick and proceed to amble through this village of under five hundred inhabitants, a typical example of England's gradually dwindling rural population, with numerous thatched cottages above which, in the distance, peeps the tower of the old church. Through the middle of the main street runs a brook, and as I walk along my attention is arrested by a notice nailed to a tarred wooden barn, at a height so that all may see. On a card about twelve inches by eight, written in bold, easily legible handwriting, I read the following with profound interest, having seen something similar in more exalted places:—"Tenders are invited to light the two main street lamps during the ensuing winter. Particulars may be obtained from ———, to whom all tenders should be sent not later than October 31st next."

I look round to try to locate the position of these street lamps, and a vision of the mighty 132,000-volt transmission lines in the county of Bedfordshire springs to my mind. None of these humbugging innovations here! After all, although we may be lagging behind Russia in our electrical development, and although I remember seeing transmission lines strewn over the beautiful panoramas of Switzerland, we must not desecrate the beauties of our countryside. There are limits to which civilisation can penetrate. And I gaze at the two oil lamps which these unæsthetic electrical heathens would utterly destroy. Each lamp is of the conventional glass funnel, oil wick-burning type, mounted on an iron bracket thick with rust, projecting from a dilapidated wooden post about ten feet from the ground. The lamps are about fifty yards apart and close to two wooden plank bridges across the brook, apparently to prevent midnight revellers from toppling into the water. I understand, however, that the lights must be turned out at 10 p.m., and on moonlit nights the lamplighter has a holiday.

Well, here is a position going begging which is undoubtedly a job for life. It has its attractions, and may light the way out of darkness in more senses than one. Even such a post may have its compensations to an electrical engineer with a philosophical turn of mind.

"Tenders are invited . . ." I am seriously thinking of submitting a tender. The fact that it is too late might be a point in my favour!

M. W. S.

November 21st, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

13,001. "Secondary cells." L. A. Levy and Almeida Accumulators, Ltd. May 3rd, 1928. (321,405.)

13,181. "Railway signalling systems" F. Kruckenberg. May 5th, 1927. (289,894.)

13,308. "Process of and apparatus for the regulation of power-generating installations, more particularly of electric power stations." Askania-Werke Akt. Ges. Vorm Centralwerkstatt Dessau und C. Bamberg-Friedenau. May 28th, 1927. (291,089.)

16,344. "Television apparatus and the like." J. L. Baird and Television, Ltd. June 5th, 1928. (321,389.)

19,938. "Device for protecting transformers, switches, motors, generators, and similar electrical machines and apparatus." M. Buchholz. July 8th, 1927. (293,705.)

19,945. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 9th, 1928. (321,438.)

20,070. "Method of supporting the armatures of electromagnetic devices such as loud-speakers." G. D. Powell. July 10th, 1928. (321,439.)

20,234. "Television apparatus and the like." J. L. Baird, and Television, Ltd. July 11th, 1928. (321,441.)

21,093. "Electric couplings of the plug-and-socket type." J. A. Crabtree. July 30th, 1928. (321,409.)

22,157. "Volume and tone control systems in electrical sound reproduction." J. W. Cairns and F. A. Thomassin. July 31st, 1928. (321,392.)

22,254. "Electric signalling or indicating apparatus." Relay Automatic Telephone Co., Ltd., British Power Railway Signal Co., Ltd., and J. H. Graham. August 1st, 1928. (321,426.)

22,459. "Electric motors." R. Gold and J. Schmauss. August 2nd, 1928. (321,427.)

22,496. "Electric switch mechanism, and the mounting of such mechanism in boxes, cases, and the like." J. A. Crabtree. August 3rd, 1928. (Cognate application 6,660/29.) (321,428.)

22,650. "Alternating-current electric motors." Lancashire Dynamo and Motor Co., Ltd., and J. W. Howard. August 4th, 1928. (321,393.)

22,728. "Electric motors." H. F. Howells and E. C. Howells. August 7th, 1928. (321,412.)

22,903. "Loud-speakers for wireless apparatus or the like." G. R. Searle. August 8th, 1928. (Addition to 320,654.) (321,430.)

22,967. "Water-cooled vacuum tubes." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). August 9th, 1928. (321,446.)

22,995. "Electric switches." H. T. Logan. August 9th, 1928. (321,449.)

23,022. "Method of fixing heating coils and panels in walls, ceilings, or floors." Benham & Sons, Ltd., and C. R. Allensby. August 9th, 1928. (321,450.)

23,114. "Electrical circuit-interrupters." Associated Electrical Industries, Ltd. August 11th, 1927. (295,397.)

23,135. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and O. A. Pearce. August 10th, 1928. (321,454.)

23,194. "Method of heating the non-metallic covering of electric conductors, such as a single or stranded wire, cables, or the like." General Cable Corporation. August 26th, 1927. (296,085.)

24,125. "Mechanism for automatically controlling the lighting of electrically lighted vehicles." L. Gaston. August 22nd, 1928. (Convention date not granted.) (300,192.)

25,150. "Circuits comprising thermionic valves." General Electric Co., Ltd., and E. P. L. Westell. September 1st, 1928. (321,490.)

25,654. "Signalling systems for giving audible signals." A. Blondel. September 7th, 1927. (296,702.)

26,588. "Push-pull electric switches." L. H. Reid. September 17th, 1928. (321,502.)

26,690. "Electric heaters." G. H. Collins and H. F. Collins. September 18th, 1928. (Cognate applications 26,691/28 and 26,692/28.) (321,503.)

27,776. "Gas-treating devices for enclosed electrical apparatus." A. G. Ellis, H. Diggle and Associated Electrical Industries, Ltd. September 27th, 1928. (321,513.)

28,627. "Fittings for electric lighting and the like systems." P. A. Smith, Dr. O. Faber and Drake & Gorham, Ltd. October 5th, 1928. (321,522.)

28,688. "Reproducer units adapted to be actuated by a gramophone record for producing electrical impulses." Igranic Electric Co., Ltd. October 5th, 1927. (298,209.)

28,848. "Electromagnetic switch." W. Schweitzer. October 8th, 1928. (321,523.)

30,000. "X-ray tubes." British Thomson-Houston Co., Ltd. October 18th, 1927. (298,987.)

30,834. "Ceiling-roses and like electric fittings." W. V. Butterfield, A. W. Butterfield and S. Butterfield (trading as Mycromet Manufacturing Co.). October 24th, 1928. (321,533.)

30,835. "Cord grips for electric lampholders, adapters, and the like." W. V. Butterfield, W. E. Evans, A. W. Butterfield and S. Butterfield (trading as Mycromet Manufacturing Co.). October 24th, 1928. (321,534.)

51,853. "Telephone cables." Siemens & Halske Akt. Ges. May 20th, 1928. (Addition to 284,664.) (312,335.)

32,533. "Electric switches." R. H. Baker and C. W. Parsons. November 7th, 1928. (321,547.)

32,571. "Electric dynamos or motors." J. Lucas, Ltd., E. O. Turner and E. H. C. Robinson. November 8th, 1928. (321,549.)

32,802. "Electrode construction for electron-discharge tubes." Mullard Radio Valve Co., Ltd., and B. Krol. November, 9th, 1928. (321,553.)

33,111. "Thermionic amplifier circuits." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 12th, 1928. (321,560.)

33,182. "Apparatus for maintaining a constant speed of electric motors." G. A. Cox. November 13th, 1928. (321,562.)

34,904. "Method of and means for cleaning the electrodes of electrical gas-cleaning apparatus." Lodge-Cottrell, Ltd. (Metallges. Akt. Ges.). November 27th, 1928. (321,571.)

1929.

481. "Control of prime mover plants." British Thomson-Houston Co., Ltd. January 5th, 1928. (303,525.)

935. "Electric reversing switches." Scintilla Akt. Ges. March 1st, 1928. (307,012.)

1,304. "Lighting-device for vehicles." G. F. Blanchod. January 14th, 1928. (304,143.)

1,808. "Regulating transformers." International General Electric Co., Inc. January 18th, 1928. (304,290.)

2,950. "Micro-telephones." H. N. Skerrett (Fuld & Co., H., Telephon- und Telegraphenwerke Akt. Ges.). January 29th, 1929. (321,612.)

4,182. "Direction-finding radio apparatus." Telefunken Ges. für Drahtlose Telegraphie. February 8th, 1928. (305,632.)

7,056. "Synchronous reproduction of picture films and disk sound-records." C. H. Verity. August 13th, 1928. (Divided application on 318,847.) (321,624.)

11,955. "Electric transformers." British Thomson-Houston Co., Ltd. April 18th, 1928. (309,955.)

14,411. "Mercury electric switches." Dr. P. Meyer Akt. Ges. May 8th, 1928. ((311,283.)

23,778. "Electric signalling or indicating apparatus." Relay Automatic Telephone Co., Ltd., British Power Railway Signal Co., Ltd., and J. H. Graham. August 1st, 1928. (Divided application on 321,426.) (321,415.)

27,232. "Switch-fuse." C. W. Cox and C. E. C. Shawfield. June 9th, 1928. (Divided application on 320,356.) (321,463.)

32,158. "Electric switch mechanism, and the mounting of such mechanism in boxes, cases, and the like." J. A. Crabtree. August 3rd, 1928. (Cognate application 32,159/29.) (Divided application on 321,428.) (321,416.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 27th:—

Celestrola. No. 502,917. Class 8. Instruments and apparatus for signalling, and parts thereof, &c.—Celestion, Ltd., 145a, London Road, Kingston-on-Thames.

Oscillophragm. No. 503,122. Class 8. Radio-telephonic loud-speakers.—Graham Amplion, Ltd., St. Andrew's Works, Slough.

Trojan Electric Recording, Made in England (lettering and design). No. 506,763. Class 8. Radio-telephonic apparatus and parts thereof, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

Maxiphone. No. 506,871. All goods in Class 8, with certain exceptions.—Lugton & Co., Ltd., 133-135, Old Street, E.C.1

Dexite. No. 503,217. Class 50. Battery cases and parts thereof, electric light standards, insulators (electrical), &c.—British Xylonite Co., Ltd., Hale End, Essex

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BEESTON.—Houses (130) for the U.D.C.; surveyor.

BEXHILL.—House, Haddocks Hill; E. Bunce.

BLACKBURN.—Cinema, Audley Lane, for A. G. Wilson, West Kirby, Liverpool; Gray & Evans, 51, North John Street, Liverpool.

BOLTON.—Cinema, Bark Street; W. & S. Bradley, architects.

BRENTFORD.—Improvements, Court House (£15,687); Fassnidge & Sons, Ltd.

CARSHALTON.—Church, for the Baptist trustees; secretary.

CHESTER-LE-STREET.—School (448 places), and dining hall, secondary school, for Durham E.C.; F. Willey, architect, 34, Old Elvet, Durham.

CHORLEY.—Pump House, Lower Healey Bleachworks; J. T. Holt, Ltd.

CROYDON.—Houses (36), Falkland Park Avenue; P. Richardson. Alterations and additions, 39-47, North End; Batchelor & Son, Ltd. Alterations, 19-21, George Street; John Barker & Co., Kensington. New schools and rebuilding of Beulah and Oval Road schools for the Borough E.C.; A. Sunderland and J. M. Sheppard, architects.

DUNDEE.—Reconstruction of Her Majesty's Theatre as cinema (£35,000); the manager. Reconstruction of La Scala Picture House; the manager.

EASINGTON COLLIERY (Co. DURHAM).—Re-erection of miners' hall, and cinema, for the Miners' Lodge; G. W. Bloomfield, secretary (£9,000).

EAST LOTHIAN.—Police stations at Prestonpans (£3,993) and Tranent (£3,810); county clerk, Haddington.

EASTRY (KENT).—Additional 118 houses, for the R.D.C.; surveyor.

EPPING.—Remodeling church schools, for the managers; J. Stuart, architect, Springfield Old Court, Chelmsford (returnable deposit of £1 1s.).

FARNHAM ROYAL.—Senior school and extensions, junior school, for Bucks E. C.; education architect, Aylesbury.

FAVERSHAM.—Business stores, Market Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

FENTON.—Houses (61), Vivian estate (£20,949); C. Cornes and Son, Hanley.

FOLKESTONE.—Five schools for the Borough E.C. (£62,917); director of education.

GLASGOW.—Buildings, Sauchiehall Street, for Bank of Scotland; the manager. Extension of cinema, Wellshot Road; George Green, Ltd. Extension of Larchfield garage for Corporation; general manager, Municipal Transport Department.

GOLBORNE.—Junior and infants' County school (£23,000); county architect, 16, Ribblesdale Place, Preston.

GRAVESEND.—Houses (170) Players site. School (600 places), King's Farm estate, for the Borough E.C.; J. G. Bennett, borough architect.

GREAT PRESTON.—School (730 places), for West Riding E.C.; J. C. McGrath, clerk, Wakefield.

GUILDFORD.—Alterations and additions, 104 & 67, Quarry Street; W. H. Smith & Son, Ltd.

HALSTEAD (ESSEX).—Additional 30 houses, for the R.D.C.; surveyor.

HAREFIELD.—Reconstruction, Sanatorium; Middlesex County Architect and Medical Officer of Health.

HAYDOCK.—School (£36,000); county architect, 16, Ribblesdale Place, Preston.

HOVE.—New school at The Knoll, and extensions to Connaught Road and East Hove schools (£37,970), for the E.C.

LANGHO.—Extensions to institution for the Lancashire Asylums Board (£90,000).

LEICESTER.—Houses, Braunstone estate; W. & H. Foulds (86), S. A. Potter (16), J. Freer (46), and Bodill and Sons, Ltd. (108). Elementary school, Imperial Avenue. Buildings for Newarke secondary school, Braunstone estate; Education Committee. Education offices, Newarke Road (£14,760); Bowles & Sons.

LIVERPOOL.—Re-housing scheme, Burleigh Street and Great Richmond Street housing scheme (256), Norris Green estate; land steward and surveyor, Municipal Buildings, Dale Street. Church at Norris Green estate; Dr. David, Bishop of Liverpool.

LLANDRINDOD WELLS.—Post office for H.M. Office of Works, King Charles Street, London, S.W.

LONDON (STEPNEY, E.)—Five blocks of tenements, Limehouse Fields; borough engineer.

(EAST HAM, E.)—Extensions, isolation hospital (£42,158), for the T.C.; borough engineer.

(POPLAR, E.)—Flats (120), Bow Brewery estate; borough engineer. Factory, Bow Road; D. H. Klausner, 22, Finch Street, E.C.

(FINCHLEY, N.)—School (400 places), Woodhouse estate for the E.C. Bank, Hill Rise and Lyttleton Road; National Provincial Bank, Ltd.

(DEPTFORD, S.E.)—Technical institute for L.C.C.; Albert Monk, Lower Edmonton. Blocks of shops, for the London C.C.; superintending architect.

(CHISWICK, W.)—Factory at corner of Great West Road and South of Boston Road; Moore & Cadley, architects, Bradford.

(HAMMERSMITH, W.)—Central school, Wormholt estate (£17,950); Albert Monk, Edmonton.

MANCHESTER.—Laundry, adjoining Moss Side public baths (deposit, £1 1s.); city architect, Town Hall.

MARGATE.—School of art, for Kent C.C.; W. H. Robinson, architect, Springfield, Maidstone (returnable deposit of £2 2s.).

MELKSHAM.—Housing scheme (30), for the U.D.C.; surveyor.

MIDDLESBROUGH.—Re-erection of joinery works, North Ormesby, for Proudlock, Moore & Co.

MILTON REGIS (KENT).—Additional 100 houses, for the U.D.C.; surveyor.

MUSSELBURGH.—Grammar school (£50,000); Master of Works, Midlothian Education Authority, Edinburgh.

NEWPORT (SALOP.)—Housing scheme (60), for the U.D.C.; surveyor.

PONTEFRACT.—Two schools (870 places), for the Borough E.C.; F. M. Farmer, clerk.

PRESTON.—Four elementary schools for the E.C.

PRESTWICH.—Offices and canteen at mills, for Waterdale Dyeing and Finishing Co., Ltd.; T. A. Fitton & Son, 19a, Corporation Street, Manchester.

RAMSBOTTOM.—Conversion of Co-operative Hall to cinema, for the Ramsbottom Co-operative Society; A. Winstanley, architect, 15, Ducie Street, Manchester.

RUNCORN.—Housing scheme (34), Helsby, for the R.D.C.; surveyor.

STOKE-ON-TRENT.—Seven shops and offices, Church Street (£13,590); Ball & Robinson.

STROUD.—Central school, Downfield (£13,000), for Gloucestershire E.C.; director of education, Gloucester.

SWADLINCOTE.—Additional 90 houses, Midway, for the U.D.C.; surveyor.

TOLWORTH.—Church, for St. Raphael's R.C. Church, Kingston-on-Thames; priest-in-charge.

TYNEMOUTH.—Development of Manor estate; S. Oswin's Estate Co., Ltd. Extensions, Moor Park Hospital; borough engineer. Alterations and additions, Saville Street and Little Bedford Street; F. W. Woolworth and Co.

WEDNESBURY.—Reconstruction of King's Hill school and two new schools, for the Borough E.C.; director of education.

WHITBURN.—School (650 places), for Durham E.C.; F. Willey, architect, 34, Old Elvet, Durham.

WHITWOOD (YORKS.)—Houses (56), for the U.D.C.; Gallagher & Son, builders.

WINCANTON.—Additional 100 houses for the R.D.C.; surveyor.

WISBECH.—Post office and telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W. (returnable deposit of £1 1s.).

WOKINGHAM.—Girls' secondary school (£15,000), for Berks. E.C.; director of education, Reading.

WORKINGTON.—Central school (500 places), for the E.C.; director of education.

YORK.—Two schools for the City E.C.; P. J. Spalding, clerk.